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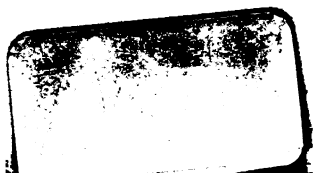
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THE LIBRARY MAGAZINE.

VOLUME 9, DECEMBER, 1881.

WOMEN AS CIVIL SERVANTS.

THE great and increasing demand for remunerative employment of women calls for frank discussion of their present position and future prospects as members of the working community. Necessity now forces many women out into the world where the law of the survival of the fittest, and therefore of the strongest, holds good for all comers. Equality with men they can never attain, for the best work will always be done by those who possess the most physical and mental power; but that the amount of energy and ability women have at their disposal will eventually command the same market price as that of the other sex I firmly believe. At present every branch of labor on which women can enter is overcrowded by them, and therefore they are ready to engage themselves at a much lower rate than would be offered to men; but when a wider range of employment shall be open to them, they will receive due pay for good service.

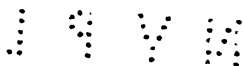
While public interest seems especially directed towards this question, viz. the necessity of providing fresh opportunities for the gain of a livelihood to the large female section of the community now clamorous, and in no way to be ignored, it is well to understand clearly what has already been done, what labor market is already open, and where any vista of fresh modes of activity may be found. At the risk of taxing the reader's

patience with a good deal of dry practical detail, it seems worth while to give an account as thorough as may be of one important line of employment which has been experimentally offered to women: that is to say, their admission to one department of the Civil Service.

One of the most encouraging prospects before women, and that because the commencement made promises of further development, is their admission to the Public Postal Service. Nearly two hundred women find occupation in three important branches of the post-office, and their numbers, it is said, are likely to be greatly enlarged. Ten years ago the Clearing House, a branch of the Receiver and Accountant-General's Office, was opened to female officers, the idea being to give employment to ladies in reduced circumstances. Sir John Tilley first suggested that these clerkships should be filled by gentlewomen, and Lord John Manners, then Postmaster-General, favored the plan, and took much interest in the nominations. In the year 1872 the staff commenced with thirty members, and gradually their numbers have been increased, and their work now embraces that of the Clearing House, the greater part of the Examiner's Branch of the Savings Bank, and the Postal Orders Examining Branch.

To give an idea of the capacities required in the workers it is necessary to state briefly the nature of their duties, and to describe the way in which these are dispatched. That a good deal of mental strain is put upon the officers will be seen readily, and that the work is no sinecure will appear from the following facts.

The clerks enter upon a six months' probation after passing an examination in arithmetic, dictation, handwriting, and grammar, under the Civil Service Commissioners, at Cannon Row or Burlington House; and at the end of that time, if their health and conduct are considered satisfactory, a report is sent in to the authorities by the superintendent, and they are fully established as second-class clerks. The salary commences from the day of entry, and is £65 a year, rising by £3 to £80 for a



second-class clerk; £85 rising by £5 to £110, for a first-class clerk; and £110, rising to £170, for a principal clerk. The age of admission is between seventeen and twenty. The hours of attendance are from ten a.m. to four p.m.; and the holidays consist of a free afternoon on Saturday and a calendar month some time during the year.

The Clearing House is situated at No 1 Albion Place, Blackfriars Bridge, and it will be remembered that this was the first branch of the Post Office in which ladies were engaged. The work here has to do with telegrams, and every telegram sent throughout the United Kingdom is forwarded here from the General Post Office for examination. In the press section on the ground floor all unpaid telegrams are received which are sent by those papers, agencies, clubs, exchanges, and news-rooms, which have made arrangements with the Postmaster-General for the transmission of news. The telegrams are sorted, their words counted, and the number entered to the names of the senders whose franks they bear, and then they are put away on the shelves round the walls. Above this room is the section for the examination of messages for small charges. All paid telegrams sent throughout England, Wales, Ireland and Scotland are counted here, and examined to see that the right number of stamps have been affixed. Such words as "cui bono" or names like "fly-by-night" are apt to be written as one word, and the clerk in whose division such mistakes occur writes a report of the error, and her decision is checked by a principal clerk. The daily average of mistakes is about one hundred and fifty to two hundred, and they are all entered in a book, and the telegrams are kept for two years, in case some further information should be required. The messages found correct are returned in sacks to the General Post Office.

The Government Account Section occupies the third floor, and consists of the postmasters' abstract work, viz., daily account of the number of messages each postmaster has sent out, and the commission he claims. This work varies in quantity. During the snowstorm in January, of this year, 97,143 more mes-

ages were sent than during the same week of the preceding year. It is noticed that messages increase during wet weather, and decrease on bright sunny days. The postmasters' accounts are examined weekly, and a monthly abstract sheet is made out for the general office. The highest room is where the Government messages and those of the Queen and her family are counted and charged to the offices, and to the Controllers of the Royal Households. This apartment is far up above the noise of the streets, and a small balcony allows the clerks to breathe the fresh air from the river. A few withered ferns outside the window struggle to keep life in them, and are carefully tended by their owners, but the smoke and fog do not encourage the growth of young leaves.

The Examiner's Branch of the Savings Bank, in which ladies are employed, occupies a floor of the new building in Queen Victoria Street, and the staff numbers one hundred and thirty ladies. A private staircase leads up to this part of the building, and a dining-room and kitchen are attached to it, in order that no communication need be carried on with the other floors. This work is in three sections, and a fourth has been added by the Act for investments in Government Stock. The post-offices of the kingdom are separated into ninety-six divisions, and each division is the work of a separate clerk. The work consists in examining the signatures of depositors who withdraw money from the Savings Bank; in initialing them if found correct; and in entering the amount of the withdrawals on remittance sheets for the Receiver and Accountant-General. The notices are forwarded to the book-keeper's branch, and when returned, if found correct, warrants are sent to the depositors signed with the initials of the examiner, and advices to the paying offices. Examiners sign for withdrawals up to fifty pounds; first-class clerks to one hundred and fifty; and the superintendent for all sums over that amount. The Daily Balance Section deals solely with the postmasters, and is also arranged in divisions. The clerks receive the daily dockets of postmasters, stating the number of deposits and withdrawals in their various offices; and

they examine dates and stamp marks, report errors, and make out a daily total. The Allowance and Adjustment Section is where the allowances to postmasters are counted, the rate of payment being five pounds for each thousand transactions of deposits and withdrawals for the medium-sized offices, and two pounds a year for the small offices. The large offices receive a fixed salary, and are dealt with elsewhere. Certificates and vouchers for payment are sent quarterly to the Receiver and Accountant-General. A final adjustment sheet for all the deposits and withdrawals dealt with is made out every quarter, and must agree with the numbers taken from the ledgers in the Ledger Branch of the Receiver and Accountant-General's Office. This section is the most difficult in point of brain-work, the adjustment sheet requiring great nicety in calculation, and clear-headedness in tracing the smallest error. It is therefore the last section to which the clerks are introduced while learning gradually the whole of the work, in order that they may be ready to fill any vacancies caused by illness or any other reasons of absence among their numbers.

The section for investments in Government Stock was commenced by six female clerks under the direction of men; and although the difficulties they had to encounter were greater than any they had previously experienced, their duties were accomplished to the satisfaction of their teachers, who bear testimony that little trouble was evinced by the women in understanding the work, and who speak in the highest terms of the way in which it was done. The clerks in this section deal with the applications for investments in Government stock. They compare the signatures of the declarations with those of the applications, and initial them if they agree; they examine the books of depositors to ascertain that the balances to their credit are sufficient to cover the investments and the commission, and if so initial them; they calculate the amount of the stock sold and the commission, and enter it as a withdrawal in the depositors' books and affix the Department stamp before sending the books to the postmasters. They deal with applications for stock certifi-

cates, and calculate dividends, compile adjustment sheets of the amount of the investments, commission, and Bank of England fees, and prove the totals of the columns against the totals of the entries in the Daily Record of Investments, and Sales. As the public begin more fully to appreciate the advantages of further investment of money in the Savings' Bank this work will increase, and a larger number of female clerks will be required. The pioneers in this section were chosen from the most able of the staff, but the facility with which these grasped the idea proves that the ability for the work will not be wanting among female officers.

The Postal Orders Examining Branch began in January, 1881, at the Clearing House, and has been removed to 111 Queen Victoria Street. The clerks here engaged have been drafted in from the Savings' Bank and the Clearing House, and a few were admitted by special examination. The work is easier than in the two other branches, where women are employed, but a good deal of trouble is experienced in explaining the postal orders to the country postmasters, who, although they have the regulations in their possession, fail to understand them. Of the 13,000 post-offices in the United Kingdom 5,000 only are places where money orders are issued, the remaining 8,000 being for the collection and distribution of letters alone. But the postmasters in the remote villages of Scotland and Ireland are extremely illiterate, and much time is at present spent in correspondence where mistakes have been made.

Post-office orders were introduced in 1792 by three officers of the Inland Department of the Post Office, and the original intention was to enable the friends of soldiers and sailors to forward money to them by letter. The system was carried on at the risk and expense of these persons, who provided themselves with a chief office in the neighborhood of the General Post Office. It was a private enterprise, for which they made their own arrangements with the postmasters as to the extent of the work, the mode of doing it, and the remuneration they were to receive. In 1838 the Earl of Lichfield, then Postmaster-General,

obtained the sanction of Government for converting this private money order office into an official establishment, forming a branch of the General Post Office, under the management of proper officials, its produce being appropriated to the revenue. The number of orders issued in the succeeding year of 1839 was 188,921. The penny postage had an important effect on the business, and in 1841 the number sent out increased to 587,797. In 1856 business commenced with the colonies, and in 1860 with foreign lands. Up to 1868 there was a continuous flow of business, but in that year the parliamentary grant for education by the Privy Council Office ceased to be made by means of money order, and a decrease followed. In 1871 the rates of commission were lowered and the work once more enlarged. In 1875 the total number paid was 16,000,000.

But it was found that the Inland Revenue lost by post-office orders for small sums, owing to the large amount of clerical labor involved, and the time spent in securing safe transmission. For all sums under ten shillings a loss of twopence was incurred, that is twopence on 25 per cent of the whole. The question was discussed in committee, and it was decided that the accommodation of the poor being the object of post-office orders, some means of allowing them to the public must be discovered. Finally, a proposal was made that no money order should be issued under the charge of threepence, and that for sums less than one pound postal notes should be used, for the transmission of which less precaution need be taken than in the case of larger sums. This plan met with approval, and was embodied in the Postal Orders Act of the 7th of September, 1880.

Postmasters are supplied from Somerset House with postal notes, and at the end of each day they enter on a docket the number and value of those paid and those remaining unissued, and forward the docket with the paid orders to the Metropolitan Office. The orders are sent on to 111 Queen Victoria Street from the General Office, those of Dublin and Edinburgh in green bags, sealed. The work consists in checking the receipt of postmasters' dockets in a book kept for the purpose; in

examining each order to see that it is signed by the payee; in entering the amount of any postage stamps affixed in their proper book; in examining the signatures of the postmasters and the stamps specifying the day on which they were issued or cancelled; and in initialing the dockets if found correct. The numbers are entered on a Division Sheet, to be sent to the Cash Account Branch, that the amount of each postmaster's payments may be compared with the amount claimed in his cash account. The orders are then tied up in packets and laid in the pigeon-holes of their respective divisions in the labyrinths of cupboards at the top of the house.

The Money Orders business grows daily. The facility with which postal notes are sent renders them extremely popular, not only with the poor, but with all classes. To have a stock ready at hand for sending small sums of money, paying bills and subscriptions, is a saving of time and trouble, especially to those who live in the country at some distance from a market town. With the aid of stamps they can be made up to any sum of shillings and pence, and are less expensive than post-office orders, and safer for transmission than stamps. This work as it develops will furnish occupation for a large number of women who will have the satisfaction of knowing that this division is entirely worked by themselves.

It will be seen from the above that the work in which these women are engaged is not mere manual labor, but requires careful application as well as skill of hand. One careless mistake involves endless trouble, for the accounts are kept with such precision that one penny miscalculated has to be searched for through numberless papers until it is checked. The hours are not long, but every moment spent in the office, except the dinner half-hour, is persistently employed, and the tension put on the power of the officers is too great to last over a longer time. Some few of the clerks are advised to retire after the six months' probation if it is found that although they could pass the examination they have not the quickness necessary for the work; but the greater number remain and advance gradually,

the berths being too highly appreciated to be left for other employments.

In contrasting the work of the women with that of the men in the Post Office, the authorities say that the women are more conscientious, and take a greater interest in their occupation.

This is perhaps only too easily accounted for when it is remembered what is the class of women who are here employed.

The three branches of the Post Office of which I am speaking were opened to women with the express intention of giving occupation to "ladies," and as each appointment has been made by the Postmaster-General this rule has been strictly adhered to. The women in the Telegraph Department and other Post Office work are distinct from these clerks, and their social position is not inquired into when they are admitted. But these specially appointed clerks were not born with the prospect of work lying before them, and many a sad history is connected with their entrance on official life. The young men in the Post Office spend their time in exercise or amusement when the hours of work are over. Many of the women go home to continue their exertions in some other form. The salary is small, and one tries to increase it by giving lessons; another by sewing; a third in drudgery of a domestic kind. The continuous close application is often found a relief from pressing thoughts of great sorrow or loneliness; or there may perhaps be anxiety to rise as rapidly as possible to a higher position in the section, that a larger salary may be obtained. The clerks in some cases have others depending on them. Lodgings, where two idiot brothers are her only companions, is the home of one woman. A solitary attic near London Bridge is the home of another of these clerks. Possibly the women plod more steadily than the men do. At any rate the authorities are satisfied that nothing is wanting among them of quiet, business-like ways.

An article in the *Quarterly Review* for January, on the "Employment of Women in the Public Service," draws attention to the rate at which female clerks are paid in the Post Office, and regrets the disparity between their salaries and those of the

men. Less than half the amount of remuneration is received for doing the same work in quantity and quality, and this although the women are now performing a higher class of duties than at the time when the salaries were originally fixed.

It should be remembered that three reasons underlie this apparently unjust disparity, viz., the health of the women, the extra accommodations supplied expressly for their comfort, and, above all, the present market price of their work. Absence from ill-health is far oftener the case with the female than the male clerks; the daily routine tells upon the women, and the repetition without break of the same monotonous employment seems to wear them a great deal more than it does the other sex. The constant confinement, the want of fresh air, and the upright position, all tend to increase the average of absentees, and to swell it above that of the male officers. Added to this is the fact that many live at long distances, and travel backwards and forwards in stifling third-class underground railway carriages; many bring little or no lunch with them, and abstain from ordering food in the building; many work hard after office hours, and thus use more strength than they ought to expend. Thus they are oftener absent from their posts than the men, and during rough weather they are more apt to fall ill. The arrangements made for their comfort are all extra expenses, and have to be deducted from the money they earn. Kitchen fires, cooking, and the wages of the housekeepers who live on the premises to prepare their dinner, are luxuries the men do not require. Necessities, I should rather say, for strict rules forbid the female clerks to leave their apartments from the time they arrive until they depart in the afternoon. The dining-halls are furnished with every comfort. Dinner, consisting of hot meat one day and cold meat and pudding the next, is served at one o'clock, with tea, coffee, or beer, as the clerks may desire.

Lastly, and above all, the market price of the work is the present rate of payment, and only time can alter the fact. Were all the female clerks to resign in a body their places would be filled in a few days. The market is overcrowded, and while this

remains the case all arguments in favor of an increase of wages fall pointless. It is true forty pounds is too little to live upon, therefore women who cannot afford to wait until they rise to be first-class clerks must seek a livelihood elsewhere. The employment of women is certainly a great saving to the service, but when they were admitted it was for the express purpose of economizing by cheap labor. Reference is also made in the *Quarterly* article, already quoted, to the changes rumored as likely to take place in the mode of admitting candidates, "Do not disturb Camarina, for it is better undisturbed." A responsive echo to this sentiment is found among the ladies themselves. They have for so many years enjoyed the exclusiveness of these clerkships that they dread the day when the door will be opened to all classes. The other branches of the Post Office in which so many women are working, are separate from them at present, and they are afraid when private nominations are no longer given they will be forced to associate with women of all grades. There are so few things "ladies" can do, it is said, that it is hard to take from them their opportunities here.

Women have yet to learn that in work there can be no distinction save that of intellect. To put up shelters for the few is scarcely fair by the multitude, although pleasant enough for the chosen ones.

If private nominations are done away with, and the entrance examination is made more stiff and thrown open to all classes, subject to an Oxford or Cambridge certificate, there will no doubt be a mixed crowd eager to become civil servants, because the clerkships are better paid and afford more freedom than most woman's work. Girls from High Schools and Girton students will compete, and no question will be asked as to social position. "Ladies" will no longer obtain appointments by interest, but will be forced to measure their strength with their struggling sisters, and to be content to take the places due to them by reason of individual merit. Hard as this appears at the moment, when we look into the matter we see that it will finally be good for all.

The number of female clerks is largely increasing. The Act for Investments in Government Stock and the Postal Money Orders Act have created two new fields for their efforts. The authorities are pleased with their work and willing to enlarge their numbers. The Postmaster-General, speaking of the staff of officers in his report for 1875, when women were first admitted to the Savings Bank, says: "As a further extension of female employment in the Post Office I have had the satisfaction of directing the formation of a class of female clerks in the Savings Bank. Although in arithmetic, at least, the standard of acquirement is high, a majority of the candidates succeed in passing the examination." That women clerks have gained in favor is proved by the rapid extension of their field of operation. All this points to an increased demand for their services, and holds out hopeful prospects of their being admitted to more branches of the Post Office and to other Government offices.

Here is work for the many highly educated girls in our schools and colleges, who are being trained in the very knowledge most necessary for labor as civil servants. The fact that the raising of the entrance examination is contemplated shows that the work is to be correspondingly hard. The women who have the ability to pass the examinations will not be unpleasant associates for the clerks already employed, and "ladies" entering under the new régime need have nothing to fear from their future companions.

But if the office work grows harder and becomes of a more complicated nature, it necessarily follows that only clever and capable women will be able to pursue it, and the incapable ones will not compete at the examinations.

What is to become of those who possess little ability and who nevertheless are forced to provide for themselves?

The dearth of employment is so great everywhere that ladies cannot do better, it seems to me, than take advantage of everything open to them, and thankfully accept all positions, making as light of the attendant discomforts as they possibly can. If the best clerkships are out of their reach, let them be contented

to enter lower branches of the service, such as the Central Telegraph Office, the Return Letter Office, or even the Post Offices in London and the country.

I do not pretend that these places offer the advantages of the three branches I have already dwelt upon. The salaries are less, and the arrangements include grave difficulties for timid, tenderly nurtured women; but in the struggle for bread this class of work is safe and respectable.

The Central Telegraph Office employs a mixed staff of 1,533 officers, which consists of 933 men and 600 women. They enter at the age of fourteen to eighteen in order that they may acquire the necessary manipulatory skill while their fingers are supple, and after passing an examination in arithmetic, writing, and dictation, they are sent to the school of Telegraphy, and learn to work the various instruments, the Wheatstone, Duplex, Souder, Quadruple, Morse, and Single Needle. When proficient, which is generally in about three months' time, they are drafted off to the Central Office as vacancies occur. At first they perform minor duties, and assist the officers in charge, but when able to work alone they receive the sole care of an instrument. They sit in one large room, boys, girls, men, and women together, and help one another when stress of work calls for two clerks at one instrument. The women work eight hours daily, coming on in relays between 8 A.M. and 8 P.M. They have a whole holiday on Sunday. The night duty and Sunday duty falls entirely on the men, who grumble a little at the extra work the presence of the women entails.

The Instrument Room is divided into two principal portions, the Provincial and Metropolitan, and these are subdivided into divisions and groups, seven in the Provincial and six in the Metropolitan Department. The north-east and south-east wings are set apart for the 283 instruments communicating with the various Metropolitan Postal Telegraph Offices; the remaining wings and the centre contain 221 instruments communicating with the provinces, Scotland, Ireland, and the news and special racing circuits. There are numerically fewer instruments in the

Provincial than the Metropolitan galleries, but they embrace a large number of the fast-working automatic apparatus, and are harder to work than the rest, and therefore more in the hands of the men, the boys and women being congregated in the Metropolitan Department. At one end of the central gallery are twenty-four pneumatic tubes connecting seventeen of the important offices in the City and the West-End with the Central Telegraph Office. Several of the foreign cable companies and other offices communicate in the same manner. The House of Commons has a tube about two and a half miles long through which messages are blown, in from five to seven minutes. Tubes, working to offices in the West Strand and Lower Thames Street, about two and a half miles in length, have their messages transmitted in from three and a half to five minutes. The messages are drawn in by suction to the Central Telegraph Office, and are sent up to the instrument room by pressure from the engine room below. About 40,000 to 50,000 messages is the bulk of the daily traffic, and a large number of these are transmitted messages, and have to be received and forwarded, and therefore should practically be counted twice in the total. Besides this there are from 5,000 to 6,000 local London messages and a vast number of news messages. The greater part of the work is done between the hours of eleven and three, a lull occurring in the afternoon. This work is a barometer of business, varying from day to day, and increasing largely on race days, heavy parliamentary days, or when any matter of general interest takes place. The supervising officers are both men and women, and they are allowed to inflict the punishment of extra hours if they discover any neglect of duty. The dinner is served on the premises in separate rooms, the Département providing fire and extras, also tea at four o'clock in the Instrument Room.

Women were employed here as early as 1853, while the wires belonged to the Electric Telegraph Company, and the number was increased in 1870 when the transfer of the wires to the Government took place. Considering the amount of work they perform, and the absence of night and Sunday duty, the salary of the women is in proportion to that of the men, being 8s. when

first admitted, and rising gradually to £78 a year, while the men receive 12s. to commence with, and rise to £160 a year; the supervising officers are paid higher. The female staff must always be considerably smaller than the male staff because of the many duties connected with the service they cannot perform, and also on account of their health, which suffers under extra pressure and prevents them from being reliable officers when any unexpected rush of business comes on. The manipulatory skill is found largely among them, and in time they become accustomed to the deafening noise of the machinery and the excitement of the employment. The work is rapidly increasing, and the number of women engaged will advance as the number of men advances; and their scale of pay will rise if it is found well to raise the pay of the department. Every possible care is taken of their comfort, and the rooms devoted to their use are perfect in arrangement. A few leave as incompetent, but great efforts are made to keep them in the service and not to send them adrift if it is possible to find work that they can do.

Another department of the Post Office, the Return Letter Office in Telegraph Street, employs a staff of fifty-five women, and they work by themselves, with the exception of three of their number, who are engaged in the Enquiry Office, where personal enquiries are made for lost letters. The qualities required for this employment are good hand-writing, quickness, and patience. The work is to return lost letters to the senders, the letters having been examined before they arrive in this section, and destroyed in cases where the discovery of the names of the writers seemed hopeless. The letters lost during the year average one in twenty, 2,013,149 in all. Of these 1,759,748 are returned, and 253,401 are destroyed. The post-cards lost are about 71,754, and 39,649 are returned, and the same is the yearly average for newspapers and circulars. All articles lost in the post, or dead as the postmen describe them, are sent here—photographs, cheap jewellery, shoes, even umbrellas, to say nothing of white mice, rats, and serpents. Flowers from all countries are in vases on the tables, the rest of the things are in cupboards to be kept for two months, and when of value three

months, and then to be sold by the Post Office auctioneer. At Christmas, Easter, and on Valentine's Day the cupboards are filled with presents badly packed, or bearing wrong addresses, while the senders are anxiously expecting the answers and thanks which they never receive. Letters sent from England to foreign lands and the colonies are returned every year to about the number of 204,572, principally those to Irish emigrants who have changed their abode, and who are unable to write to their friends at home without the aid of a priest. The work of the whole staff is 7,000 letters daily, each member being obliged to return 280 letters, and a larger number if she is dealing with post-cards, papers, or circulars. The hours are from half-past nine to five. They have a half-holiday on Saturday. The salary is paid weekly, and is 18s. to 20s. for a first-class clerk, and 14s. to 17s. for a second-class clerk. The dining-hall joins the office, and dinner and tea are supplied at a moderate charge. The whole place is bright and cheerful, and the flowers lost in the post add not a little to the pleasure of the officers. This work is also increasing, although it might be supposed that education had advanced far enough to enable people to correspond without giving so much trouble to the Post Office, but a little knowledge enables a great many people to use pen and paper, and a great deal does not teach them the advantages of writing a clear and readable hand.

The female telegraphists engaged in the post-offices of London and the large provincial towns are between one and two thousand, and they work at the same rate of pay and the same number of hours as in the Central Telegraph Office. They are trained in the Postal Telegraph Schools, after passing an examination under the Civil Service Commissioners, and as yet must obtain nominations to their posts through the interest of friends. They are never allowed to remain after eight in the evening, and during the day work behind partitions that screen them from the public, but all the same they are obliged to sell the stamps, post-cards, and orders required, as well as to do the wire work. They have generally a small room joining the office, where they retire for dinner, and here they make their

tea, and sit when off duty. The eight hours' work leaves them free to employ their evenings as they please, or to engage in other occupations if not too tired. I will not contrast these places. I would rather they spoke for themselves. Gentlewomen entering in large numbers for the examinations would find more companions of their own class. It would be quite possible for them, moreover, to work comfortably with both men and women of the present staff, although they might not care to introduce their working associates to the familiar equality of social intercourse. In the Central Telegraph Office the supervision is too strict to allow of much conversation, and gentlewomen, by exercising a little tact and good nature, would meet with nothing disagreeable from the fact of the staff being mixed. The publicity of the enquiry office in the Return Letter Branch, and of the post-offices of London and the large towns, creates a difficulty which it would require considerable courage to encounter, but the freedom and independence of these places render them preferable to many positions as governesses, school-mistresses and companions.

A pension can be hoped for after ten years' service if the officer is disabled, and this is something to fall back upon as old age creeps on, and prevents undue saving in the present under dread of exigencies looming in the future. Women as civil servants have the comfort of knowing they are the children of the Government, and that they are not likely to be turned away when their powers are exhausted, or to be ungratefully forgotten when their services are of no further use.

The present rate of payment is not low, when it is measured with the remuneration received in other places by women, and only appears small when contrasted with the salaries given to men.

It must not be forgotten that men object strongly to the system of cheap labor, and dislike the increased competition for the trouble it gives. As the women press gradually from below, the men are forced into other spheres of action, wider ones, and further from home.

But necessity now compels large numbers of women to seek

occupation; and we cannot but admire the quiet and determined way in which women as a class have taken possession of every fresh field of labor thrown open to them. As greater variety and multiplied subdivisions of work arise under the development of a complex civilization, gradually there will be less pressure at any given point, and the fictitious conditions will decrease under which the female worker finds herself forced to give her labor at a lower rate than it is intrinsically and comparatively worth. Patience is all that is needed, and a bond of mutual helpfulness, binding together all women irrespective of class to meet the obstacles incident to changing social conditions of life.

MARGARET E. HARKNESS, in *The Nineteenth Century*.

IN WYOMING.

TWENTY-FOUR hours after landing in New York my preparations for a journey to the far west were completed, and I found myself looking out from the windows of a Pullman car that rapidly swept past the blue reaches of the Hudson. A project which had been little more than a dream for many years was now at last actually realized. Let me briefly explain this project, that the purport of the journey, and of the following notes, may be understood.

And first I would give the reader due warning that the object of the expedition was not sport or adventure, but science. My companion and I were not, indeed, wholly unarmed. To go without at least revolvers into these western wildernesses would, we were told, be sheer folly. My weapon disappeared, however, in an early part of our travels, but my friend's did occasional service upon a badger or prairie hen. All the sport that was done consisted in the slaughter of the antelope or elk that was needed for food. Nevertheless, from first to last, the journey was full of interest, and in a quiet way, even of excite-

ment. We had game of our own to hunt, and we pursued it with such measure of success as at least amply to justify our own expectations, and to reward us for the enterprise.

Everybody now knows the kind of evidence from which it has been established that the present surface of the dry land has once been in a wholly different condition. In all parts of the world this evidence obtrudes itself, often so conspicuously as from earliest times to have arrested the attention of mankind, and to have suggested, or at least colored, mythology and local superstition. In many places, for example, as soon as the layer of soil or subsoil has been removed, the rock below, with its imbedded shells or corals, or other remains of marine life, is at once seen to have been the bottom of the sea. At other points we find traces of rivers which must have had their sources in mountains that have long since disappeared, and which fed lakes or watered woodlands and plains that for ages have been buried out of sight. Or, again, we come upon the earth and stones left by vanished glaciers, upon the limestone spread out by springs long ago dried up, upon the sheets of lava or heaps of ashes thrown out by volcanoes that have been extinct and effaced for ages. It is manifest, therefore, that the present surface of the land, so far from being aboriginal, is only the latest phase of a long succession of geographical revolutions, the uppermost leaf, as it were, of a series of volumes that lie beneath it. Mountains and hills, valleys and plains, instead of standing out as parts of the primeval architecture of the globe, can be shown to belong to many different epochs of the earth's long history.

But the question remains, how these familiar features have come to be impressed on the surface of the land. Granted that the solid materials out of which a mountain or table-land has been built were originally accumulated as sediment on the floor of the sea, how has this hardened sediment been fashioned into the well-known lineaments of the land? The solution of this question aroused some years ago a keen discussion, and has given rise to a portentous mass of geological literature. The combatants, as in most warfares, scientific or other, ranged

themselves into two camps. There were the Convulsionists, or believers in the paramount efficacy of subterranean movement, who, starting from the universally admitted proofs of upheaval, crumpling, and fracture, sought an explanation of the present inequalities of the land in unequal disturbance from below. On the other hand, there were the Erosionists, or upholders of the efficacy of superficial waste, who maintained that besides the elevations due to subterranean causes, mountains, valleys, and all the other features of a landscape have been gradually carved into their present shapes by the slow abrasion of the air, rain, rivers, frosts, and the other agents of subaërial erosion. The contest, which was keen enough some years ago, has for a while almost ceased among us, though an occasional shot from younger combatants, fired with the old enthusiasm, serves to keep alive the memory of the campaign.

Having long ago attached myself to the camp of the Erosionists, though by no means inclined to do battle under the extreme "quietest" banners of some of its champions, I have been led, in the course of my wanderings over this country and the Continent, to look at scenery with a peculiar interest. I have long been convinced, however, that for the proper discussion of the real efficacy of superficial erosion in the development of a terrestrial surface, the geologists of Europe have been at great disadvantage. The rocks in these regions have undoubtedly been subjected to so many changes—squeezed, crumpled, fractured, upheaved, and depressed—that the effects of unequal erosion upon their surface has been masked by those of subterranean disturbance. The problem has thus become much more complicated than, with simpler geological structure, it would have been. Its solution has demanded an amount of knowledge of geological structure which can hardly be acquired without long and laborious training, the want of which on the part of many who have taken part in the controversy, has led to the calling in question or denial of facts, about the reality and meaning of which there should never have been any doubt at all. That, in spite of these obstacles, observers in this country should have been able to brush aside the accidental or adventitious

difficulties, and get at the real gist of the matter, as I am certain they have done, seems to me a lasting proof of their scientific prowess.

Now, it is unquestionably true that had the birthplace of geology lain on the west side of the Rocky Mountains, this controversy would never have arisen. The efficacy of denudation, instead of evoking doubt, discussion, or denial, would have been one of the first obvious principles of the science, established on the most irrefragable basis of patent and most impressive facts. Over thousands of square miles the strata remain practically unchanged from their original horizontal position, so that the effects of surface erosion can at once be detected upon their flat parallel layers. The country has not been under the sea for a vast succession of geological periods. It has not been buried, like so much of northern Europe and north-eastern America, under a thick cover of ice-born clays and gravels. Its level platforms of sandstone, shale, clay, or limestone, lie at the surface, bare to the wind and rain, and their lines can be followed mile after mile, as if the whole region were one vast geological model to which the world should come to learn the fundamental laws of denudation.

For the exploration of these western territories, the enlightened enterprise of various departments under the American Government has already done a great deal. During the last ten or fifteen years various surveys of different portions of the region have been carried on, and a voluminous series of maps and reports has been issued embodying the results of the explorations. Through the courteous liberality of these departments, for which on all occasions I am anxious to express my gratitude and admiration, I had received copies of most of their publications. The descriptions of King, Hayden, Powell, Gilbert, Dutton, Emmons, Hague, Marvine, Endlich, and others; and the remarkable drawings of Holmes had made me in some respects familiar with the general aspects of the scenery and geological structure of the regions. From these works it was evident that questions over which we had been fighting so long in Europe were finally settled by Nature herself in America, after a fashion

admitting of no more cavil. It was well worth while to make a journey to the far west to see with one's own eyes the demonstration for which one had longed on this side of the Atlantic. And this was what I now had determined to do, with the companionship of an old friend of kindred tastes, Mr. Henry Drummond, of the New College, Glasgow, who from first to last shared in the work and smoothed the little privations of the journey.

Of the traveling westward, now made so familiar and comparatively easy by the various rival railroad companies, little need be said here. There is an early and late feature of it, however, to which reference may be made, partly in the hope that every renewed protest against an abuse, as offensive to many of our cousins on the other side as to a visitor from the old country, may help toward its ultimate suppression. Hardly is the traveler out of New York than he notices that every natural rock, islet, or surface of any kind that will hold paint is disfigured with advertisements in huge letters. The ice-worn bosses of gneiss which, rising out of the Hudson, would in themselves be such attractive objects in the landscape, are rendered hideous by being made the groundwork on which some kind of tobacco, or tooth-wash, or stove-polish is recommended to the notice of the multitude. All the way west to the Pacific, along the railway route, the same barbarous practice has been employed, with an ingenuity and perseverance worthy of a better cause. Some of the most picturesque cañons on the route have had their walls turned into advertising boards—for the spoilers have traveled with ladders as well as paint-pots, and have carefully inscribed their wares on precipices which would ordinarily be inaccessible. Oil-paint lasts for many years; so that even if the sacrilege be soon suppressed it will be long before the record of it has wholly disappeared.

Not many years ago Chicago lay at the extreme verge of advancing civilization. One who had been so far west could boast that he had reached the limits of settlements, and had looked on the great plains haunted by wild red men and buffaloes. Now, however, the network of railways has spread far

beyond Chicago, which is become one of the chief marts of the Union, having free communication alike by water and land with the eastern seaboard of the continent. I was making some such natural reflections as the train slowed in approaching Chicago station, when a noise as of broken glass came from the other unoccupied end of the car. The crash was loud enough to startle everybody for a moment, but the conversation and packing up of bags were immediately resumed. On going to the spot I found that two window-panes of the car had been pierced, at about the same height, by two successive bullets from a revolver. One of the balls had made a clean, sharp hole in the plate-glass, and would no doubt have continued its journey through the body of any unfortunate occupant of the seat. This was our first experience of "Western life." We looked next morning in the papers for an account of the "outrage," as it would have been termed by our penny-a-liners at home. It was not mentioned at all. We found, however, records of so many successful shootings that the non-insertion of our episode was easily to be explained. The incident impressed me with a sense of recklessness in the use of firearms and disregard of life—an impression that was not effaced by the rest of the journey.

We crossed the Mississippi at night, and having some time to wait at the Quincy junction, walked down to the banks of the river and reverently dipped our hands in the great "Father of Waters." Lights gleamed from the further side, heightening the effect of vastness and mystery. Behind us, too, gleamed the much brighter lights of rival drinking saloons, from which, before resuming the journey, we were enabled to enlarge our rapidly growing vocabulary of American drinks. The Missouri river at Kansas City is the muddiest, most tumultuous flood of rolling water I ever saw. Yet it was now the month of August, and there had been a long course of previous dry weather. The train carried us slowly across a creaking wooden bridge over the boiling sea below, past some cliffs of old alluvium, into a station full of negroes, of whom there had been a large influx from the South in search of a proposed settlement in Kansas. There being now some kind of picnic or holiday afoot, they were a

merry, noisy crowd, dressed out and bedizened as only niggers can be. One seldom realizes what an extraordinary variety of tint there may be in a colored population. Some of the excursionists were of the most perfect coal-black shade, from which every gradation could be noted till the crisp hair and characteristic features remained as almost the only traces of negro blood. Westward still, through endless monotonous miles of maize and yet unbroken land, the train moved wearily, hour after hour, until on getting up in the morning we found ourselves unmistakably on the great prairie at last. Perhaps no type of scenery so closely fulfills a previous mental picture of it as the western prairie of North America. Seen after a hot summer, it spreads out as a vast treeless, arid expanse, covered with a short and sparse grass, which though green and flowery in spring, becomes parched by drought into a kind of hay, through which the baked soil everywhere peeps. For hundreds of miles together the undulations never rise into hills nor sink into valleys. A sluggish streamlet, depressed a few feet or yards beneath the general level, winds here and there in lazy curves till it joins some sluggish and muddy tributary of the Missouri, that creeps along a level plain, bounded by low bluffs. But ere autumn comes many of these watercourses have been reduced to groups of stagnant pools.

At proper intervals stations have been built, with means for supplying the engines with water and fuel. It was at one of these halting-places that we were able to set foot for the first time on the prairie. The brief halt enabled us to make some observations that served materially to beguile the tedium of this railway journey, and to invest the featureless prairie with a new interest. Every traveler across the continent has remarked the incredible number of ant-hills and burrows of the prairie-dog and gopher by which the flat, bare surface of the plains is marked. The ground appears to be in a constant state of cutaneous eruption. So leisurely does the train move along, however, that for some hours after daylight we sat looking out on this singular scene before an opportunity came of getting down to have a closer view of it. We noticed that though the

general color of the soil is dirty yellowish gray or drab, the ant-hills have a somewhat pinkish tint. Our first halt revealed the curious fact that this difference arises from the choice which the ants make of their building materials. With infinite labor they pick up from the surface of the prairie the small broken crystals of flesh-colored felspar that are sparsely strewed there. The rocks underneath are various sandstones, clays, and lime-stones, the decomposition of which could never have furnished this felspar detritus. I examined a good many ant-hills, and found the same kind of fragments on all of them. The felspar grains were most abundant, but there occurred also small pieces of quartz and other minerals of crystalline rocks, and here and there some black glistening specks of coal. There seemed to be a thin crust or veneering of this kind of fine detritus over the drab-tinted soil, not thick enough to be readily observable, but yet sufficiently persistent to supply the materials so patiently gathered together into these little mounds.

No warning bell gives the traveler notice to resume his place in the cars, and we had just time after hearing the "All aboard!" of the conductor to regain the train, more puzzled than ever by the prairie ant-hills. The source of this fine felspar drift, and the cause of its being spread so thinly over the many hundreds of square miles it evidently covered, were questions in the history of the prairies which we could not answer, but to which we were able to return with more light and increased interest on the homeward journey. At last, on the far western horizon the first summits of the Rocky Mountains rose like blue islets out of the sea. Hour after hour, as the train ground its dusty way over the plain, these islets rose higher, till at last they united into the long noble range of the snow-streaked Colorado Alps, with Pike's Peak, Long's Peak, and a host of other broad-based cones towering far up into the clear air.

It was no part of our programme to linger among these mountains. Yet we must have a peep into them in passing. Curious and interesting that peep proved to be. The first few hours showed us on what a different plan these mountains had been constructed from that which is more familiar in the old

world. Approaching the Alps, for instance, you cross a succession of parallel minor ranges, or foot-hills, like the Jura, which flank the more colossal ramparts behind them. But these Colorado mountains tower straight out of the plain. For hundreds of miles to the east the cretaceous or tertiary strata underlying the prairie seem to be nearly flat or only very slightly undulating, though there is a steady rise of the ground westward. But at the foot of the mountains they are at once abruptly pitched up on end. So sharp and sudden is the bend that it would hardly be an exaggeration to say that you might sit on the flat beds and lean your back on the vertical ones. From some points of view the solid sheets of rock make a magnificent curve from the plains up into the line of serrated crags which their broken edges present against the sky. The meaning of this structure is soon apparent when the traveler ascends one of the numerous deep gorges or cañons into which the flanks of the mountains have been trenched by the erosion of the escaping drainage. In the course of a brief space he finds that he has crossed the uptilted formations, and has reached the ancient granitic and crystalline rocks, which have been driven up like a huge wedge through the younger strata of the prairies, and now form the axis of the Colorado mountains. But for the protrusion of this wedge the "Centennial State" would have been a quiet pastoral or agricultural territory like the region to the eastward. The rise of the granitic axis, however, has brought up with it that incredible mineral wealth which in a few years has converted the loneliest mountain solitudes into busy hives of industry. Places that a few years ago were haunted only by wild beasts, and probably hardly ever saw even a red man, now count their population by thousands. Mining camps have grown into cities, with important public buildings, hotels, and many of the luxuries as well as vices of modern city life. There is a feverish rush westward. Advertisements placarded all over the Union by rival railroad companies show the cheapest and quickest route to the new El Dorado of Colorado, and hold out tempting prospects of rapidly acquiring a fortune there. We found ourselves unwittingly moving west-

wards on this wave of emigration. It was tacitly assumed that we, too, were bound for a "claim" somewhere.

After a glimpse at the cañons and camp-life of these uplands, we skirted their eastern slopes, amid mounds of débris which renewed our interest in the problem that had been started by the prairie ant-hills. Without halting at that time, however, but pursuing our way westward by the Union Pacific Railroad, we made no stop till we came within sight of the Uintah Mountains in Wyoming. This long journey is marked in the recollection of a traveler by the complete demolition of his previous mental picture of the "Rocky Mountains." Misled by the absurd and utterly false system, still far from extinct, of representing a watershed on a map by a continuous range of mountain chain, most people have grown up in the belief that the backbone of North America consists of a colossal rampart of mountains, which traverses the continent as a continuous range running in a nearly north and south direction; and so extraordinarily rugged as to have deserved the special appellation of "Rocky." No conception could well be further from the reality. To depict the American watershed in this way is nearly as erroneous as it would be to draw a lofty mountain chain from the Pyrenees across the heart of France, Switzerland, Germany, and Russia, as indicative of the watershed of Europe. Such is the force of habit engendered by the long use of faulty maps, that though we knew what the true structure of the country had been shown to be, it was yet with a feeling almost of incredulity that we looked out upon the scene on either side of the railroad track as the train approached the summit of the route. The Colorado Alps had sunk down into a series of low ridges, though we could still see in the far distance some of their more notable peaks. Northward the tops of some distant hills in Wyoming loomed up on the horizon, but all round us not only were there no mountains, but hardly anything that deserved to be called a hill—certainly nothing that for a moment suggested the crest of a mountain range. The railway company, with a laudable desire for the diffusion of correct geographical knowledge, has had a board inscribed "Summit of the Rocky Moun-

tains," and placed at the highest level of their line. One looks round with a feeling of disappointment for the peaks and crests that ought to have been there. Instead of these, there is the same long smooth prairie-like slope, out of which rise numerous quaint knobs of pink granite. The central wedge, not having been driven so far upward here, forms no conspicuous feature at the surface. Yet it has carried up the same red sandstones on its eastern flank that rise in vertical bands among the cañons north of Denver. From the plain of the Missouri the prairie, there about 1,000 feet above sea-level, rises slowly in elevation westward, till at Cheyenne, a distance of rather more than 500 miles, its surface has an average elevation of about 6,000 feet. In the next eighteen miles, however, it makes a more rapid slope, for it mounts to an elevation of 8,271 feet above the sea. The loss of the cherished delusion about the aspect of the Rocky Mountains was in some small measure compensated by a glimpse we had of the source whence the prairies have derived their fine detritus and the ants their favorite pink building materials. The granite of this elevated plateau is a bright flesh-colored rock, crumbling into sand, the grains of which are mainly of pink cleavable orthoclase feldspar. Exposed to all the vicissitudes of weather at so great an altitude, the rock readily disintegrates. Every shower of rain washes down some of its detritus, which is further carried far over the plains by wind. It was no doubt from such a rock as this that the widespread feldspar drift of the prairie had been derived, and this very ridge had probably furnished a due amount of it.

After crossing the summit, the railroad track descends slowly into the elevated plateau known as the Laramie Plains, which still drain eastward into the Atlantic. Not until the train has crossed this dreary region for some 150 miles or more does it reach the true watershed of the country. And then, instead of a colossal rampart of rugged mountains, we find still the same monotonous plains on which the few names that have been affixed to localities—Red Desert, Bitter Creek, Salt Wells, and others—sufficiently denote the sterile character of the region. We were now among the head-waters of the great Colorado

River on the Pacific slope of the continent. But of visible slope there is for a long way no trace. It is a bare, treeless, verdureless waste, crumbling under the fierce glare of a cloudless sky and the hot blast of a parching wind. Yet for long ages these deserts were the site of a succession of lakes, vaster in size than any now existing on the American continent. The water has disappeared, and out of the hardened clay and marl of the lake bottoms the elements are carving some of the weirdest scenery on the face of the earth. Every mile of the dusty journey now brought with it new and still stranger proofs of this marvelous erosion. At one moment we were looking out on what might have been taken for the bastions of a fort that had stood a long siege. Another curve of the line brought into view seemingly the moldering battlements and decayed acropolis of some early heroic city; at the next turn the array of rock-forms could find no adequate parallel in human architecture. Scenery more indescribable can hardly be conceived. As yet, indeed, all we could see or know of these "Bad Lands" was from the windows of the car. But we saw clearly enough by their level lines of stratification that their forms had been sculptured out of horizontal rocks by surface agents. League after league this lesson of utterly inconceivable waste rose out impressively on either side, until at last, when we reached Carter Station, we almost felt that we had seen about as much as our faculties could very well assimilate. But much more was in store for us.

Thanks to the thoughtful kindness of my friends, Dr. F. V. Hayden, to whom the geology of western America owes so much, and Dr. Joseph Leidy, the revered Nestor of American comparative anatomy, Judge Carter was waiting our arrival, and soon carried us off, bag and baggage, to his hospitable home at Fort Bridger. In former days, before railway communication was opened across the continent, Fort Bridger was an important station on the emigrant road to Salt Lake and the Pacific coast. It is now no longer a military post, and being at a distance from the present highway of traffic, some of its disused buildings are falling into disrepair. But Judge Carter, who used to be the patriarch of the district, still lives at his post, combining in his

own worthy person the offices of postmaster, merchant, farmer, cattle-owner, judge, and general benefactor of all who claim his hospitality. His well-known probity has gained him the respect and good-will of white man and red man alike, and we found his name a kind of household word all through the west. So rapidly and completely have things been changed on this route by the formation of the railway, that in listening to Judge Carter's stories of the olden time one could hardly realize that some of the most startling of them did not go further back than fifteen or twenty years. Horse-stealing would appear to have been the one unpardonable sin in these quarters. You might kill a man outright, and it might be nobody's affair either to avenge him or to see you brought to justice for the murder. But to steal his horse was to leave him to perish on the plains; and if you stole his horse this week you might return and steal mine next. So the best method of preventing that mishap was to put it out of your power ever to steal again. Killing you was consequently not murder; it was merely punishing effectually an offense that could not be reached by any ordinary legal means, in a region where criminals were many and police were none. Judge Carter had had many experiences of horse-stealers. On one occasion, traveling eastward across the prairie with his wife and family, he found next morning the horses stolen. Such a position resembles that of a ship at sea without masts or sails. There was no station at which provisions could be procured, so that the loss of the means of transport meant starvation and death. Fortunately the judge succeeded in recovering his animals. On another occasion, having tried and convicted a horse-stealer, he sent him in custody to the court in Utah. The man was chained hands and feet, and in the course of the journey succeeded in breaking his foot-chain, and, though still manacled, tried to escape. He was of course speedily shot by the two men who had been intrusted with the mission, and who were probably a couple of dare-devils no whit better than himself. They consulted as to their next step, and finding in their writ that they were "to deliver the body of the prisoner" to the sheriff at Salt Lake City, they took the instructions in their literal

sense, stowed the body into the stage-coach, and delivered it duly at its destination.

From Fort Bridger the judge carried us to see the "Mauvaises Terres," or "Bad Lands" of Wyoming. This expressive name has been given to some of the strangest and, in many respects, most repulsive scenery in the world. They are tracts of irreclaimable barrenness, blasted and left forever lifeless and hideous. To understand their peculiar features, it is needful to bear in mind that they lie on the sites of some of the old lakes already referred to, and that they have been carved out of flat sheets of sandstone, clay, marl, or limestone that accumulated on the floors of these lakes. Everywhere, therefore, horizontal lines of stratification meet the eye, giving alternate stripes of buff, yellow, white, or red, with here and there a strange verdigris-like green. These strata extend nearly horizontally for hundreds of square miles. But they have been most unequally eroded. Here and there isolated flat-topped eminences or "buttes," as they are styled in the west, rise from the plain in front of a line of bluff or cliff to a height of several hundred feet. On examination, each of these hills is found to be built up of horizontal strata, and the same beds reappear in lines of terraced cliff along the margin of the plain. A butte is only a remnant of the original deep mass of horizontal strata that once stretched far across the plain. Its sides and the fronts of the terraced cliffs, utterly verdureless and bare, have been scarped into recesses and projecting buttresses. These have been further cut down into a labyrinth of peaks and columns, clefts and ravines, now strangely monumental, now uncouthly irregular, till the eye grows weary with the endless variety and novelty of the forms. Yet beneath all this chaos of outlines there can be traced everywhere the level parallel bars of the strata. The same band of rock, originally one of the successive floors of the old lake, can be followed without bend or break from chasm to chasm, and pinnacle to pinnacle. Tumultuous as the surface may be, it has no relation to underground disturbances, for the rocks are as level and unbroken as when they were laid down. It owes its ruggedness entirely to erosion.

But there is a further feature which crowns the repulsiveness of the Bad Lands. There are no springs or streams. Into the soil, parched by the fierce heats of a torrid summer, the moisture of the subsoil ascends by capillary attraction, carrying with it the saline solutions it has extracted from the rocks. At the surface it is at once evaporated, leaving behind a white crust or efflorescence, which covers the bare ground and incrusts the pebbles strewn thereon. Vegetation wholly fails, save here and there a bunch of salt-weed or a bush of the ubiquitous sage-brush, the parched livid green of which serves only to increase the desolation of the desert.

How, then, has this strange type of landscape been produced? The rainfall is exceedingly small, though from time to time come heavy showers that no doubt do much to furrow the crumbling sides of the cliffs and "buttes," and sweep down the detritus to lower ground. The main instrument of destruction, however, is not rain. In the clear dry air of these western regions the daily range of temperature is astonishingly great. In my own experience the thermometer rose sometimes to 90° in the shade, and fell at night to 19° Fahr. But this daily range of 71° is much exceeded. Exposed during the day to the expansion caused by such heat, and during the night to contraction from such rapid chilling, the surface of the friable strata is in a constant state of strain, under which it exfoliates and crumbles into sand. The sultry air during the earlier part of the day remains motionless. Again and again we saw mirage across the plains. The isolated buttes and projecting cliffs were broken up into clumps like trees, beneath which lay what seemed the sheen of a placid lake, though really a parched sage-brush plain, or a burning expanse of sand and alkali soil. But in the afternoon a wind always rose and swept across the country. Fortunately, during our exploration, we escaped its horrors. But it was not difficult to realize what these must be in the full blaze of summer, when the hot air, like the breath of a simoom, rushes along the desert, lifting up clouds of sand and of the fine white efflorescent dust. The powdery surface of the crumbling rocks is blown away. Wastes of loose sand, here piled into shifting dunes,

there dispersed far and wide over the desert, are continually augmented by fresh supplies of material from the same source. Every pebble that projects above the ground acquires, under the action of the ceaseless sand-drift, a curiously polished and channeled surface. And the same erosive action no doubt affects the moldering precipices of the Bad Lands. The rocks are actually ground down by their own detritus, driven against them by the wind.

To the south of the Bad Lands lie the Uintah Mountains, one of the most interesting ranges in North America; for, instead of following the usual north and south direction, it runs nearly east and west, and, in place of a central crystalline wedge driven through the younger formations, it consists of a vast flat arch of nearly horizontal strata that plunge steeply down into the plains on either side. We made an excursion from Fort Bridger into these mountains. From the arid plains the change was pleasant to the densely forest-clad flanks of the chain. We had, as guide, from the Judge, an old trapper who had long hunted in the mountains, and who had a good wallet of stories for the camp-fire at night. We shall not soon forget our first day's experience of an American forest. Starting early with the view of getting above the timber-line, and having a general bird's-eye view of the interior of the mountains, we rode for several hours through the forest, making for a far peak that rose high above the dense forest of pine. Probably the first remark of a novice from the Old World when he enters the forests of the New is suggested by the slimness and height of the trees; they look like huge poles, feathered at top, and stuck irregularly into the ground—sometimes so near each other that one cannot force one's way between two trunks. Rarely, even in the opener glades, does he meet with a really handsome, well-grown stem, throwing its branches out freely all the way up. His next subject of astonishment is the variety of stages of growth among the timber. The tiny sapling, not long enough for a walking-stick, may be seen springing up beside the mouldering prostrate stem of a departed patriarch of the forest. Between these extremes every gradation may be seen at any place where one

chooses to look, giving an impression of calm undisturbed nature and venerable antiquity. Another novelty, and perhaps the most striking of all, is the sight of so much fallen timber. Many trees die and decay, but yet remain erect, either because their roots hold, or because their stems are kept in place by the support of their still living neighbors. Others lose their stability, and topple over upon those next them. Every angle of inclination among these decaying stems may be observed. You can ride below some of them, though with the risk of having your hat switched off by some unobserved branch. Others you may walk your horse over, and an animal accustomed to the work acquires wonderful dexterity in surmounting these obstacles. But when the trunks approach the ground, or when they lie piled across each other, as they so continually do, you must ride round them; so that in those parts of the forest where fallen timber is plentiful your progress becomes provokingly slow and laborious. To us, however, everything was fresh. We rode on, hour after hour, in a kind of new world, gradually ascending till we found ourselves on the crest of a wide valley filled with pine-forest up to the brim, yet with stripes of green meadow peeping out here and there along its center. From the further side of this great depression rose the fine snow-streaked summits of the chain. The descent was less easy than the ascent had been, for the trees had fallen thickly down the steep declivity, which was further roughened by rocky ledges and fallen crags that would have been easy enough to surmount with free hands and feet, but which acquired in our eyes a novel importance from the difficulty of getting a horse over them. Nevertheless, every obstacle was successfully overcome. We climbed the opposite side of the valley, as far as it was practicable to take the horses, and then, leaving them in charge of "Dan," scaled the crags and steep slopes of débris. We were soon above the limit of tree-growth, and emerged at last on a broad bare plateau between 11,000 and 12,000 feet above the sea.

The structure of the Uintah Mountains has been investigated by several surveying parties under the Engineer and Interior departments. Having read the reports of the Hayden, Powell,

and King surveys, I was now able to take in with comparative ease the general aspect and meaning of the magnificent panorama around us. The broad central mass of the range is constructed of a flat arch of dull-red sandstones. The isolated peaks and ranges of buttressed cliffs along this part of the mountains reveal everywhere the horizontality of their component strata. Like the Bad Lands, but on a far more magnificent scale, they have been cut into their present forms by atmospheric sculpturing. Originally the rocks stretched in an unbroken sheet across the mountains; but in the course of ages this continuous mantle has been enormously eroded. Deep and wide valleys, vast amphitheatres, lofty terraced alcoves, and profound gorges, fretted with an infinite array of peaks, buttresses, pinnacles, columns, obelisks, and endless forms which defy the observer to find properly descriptive names for them, have gradually been carved out of these rocks. Isolated cones, with singularly majestic architectural forms, have been left standing in the midst of the denudation as monuments of its greatness. The world can show few more impressive memorials of the efficacy of subaërial erosion than the Uintah Mountains. There are no structureless crystalline rocks here to deceive us with their ruggedness. Every peak and crest, valley and cañon, bears witness to superficial sculpture. Wherever the eye turns it detects the same long lines of horizontal stratification that serve as a base from which the reality and amount of the erosion may be measured. To gain such a vivid impression of the importance of subaërial waste in the evolution of mountain-forms was worth all the long journey in itself. Yet to the south of these mountains, in the high plateaux of Utah and the great basin of the Colorado, the proofs of enormous superficial waste rise to such a gigantic scale as wholly to baffle every observer who has yet attempted to describe them.

A little below the summit which we had gained we found some bushes in fruit that recalled the wild gooseberry of home; near these a few stunted Douglas pines struggled for life. But of animal life at these heights we neither saw nor heard any sign, though bears, deer, and other large game haunt the

surrounding forests. Rejoining the horses and then descending as rapidly as possible, we passed on the way some little tarns filling high recesses of the mountain, but so thickly wooded round that we failed to find the ice-worn sides that were no doubt there to mark the presence of a former glacier; for no sooner had we reached the valley-bottom than abundant traces of vanished glaciers made their appearance in the form of perfect crescent-shaped moraine mounds thrown across the valley. On these were strewn huge blocks of red sandstone, borne of old on the surface of the ice from far crags on the sky-line. Each mound of rubbish had served as a more or less effective barrier in the pathway of the stream, ponding back its waters into a lake that had eventually been converted into a meadow. But far more effective than the dams of the glaciers had been those of the beaver. The extent to which the valley-bottoms in this and the other mountain ranges of western North America have been changed by the operations of this animal is almost incredible. In a single valley, for example, hundreds of acres are gradually submerged, and their cotton-wood or other tree-growth is killed. In this way the floor of the valley is cleared of timber. The beaver-ponds, eventually silting up, become first marshes and then by degrees fine meadows. Riding along the stream we passed on its banks several groups of short stakes thrust into the ground and tied together so as to form a framework, as if for low huts or wigwams. They were quite deserted, and had been so for some time. Dan told us they were constructed by the Indians for bathing purposes. Each of them is large enough to hold only one person at a time. When in use they are covered with skins, a fire is kindled inside and kept burning until a few stones placed in it are thoroughly warmed. The Indian or his squaw then creeps in, remains until perspiration has been induced, and finally dashes out into the stream below. It was curious to find this simple form of the sudatorium and frigidarium among the Utes in the wilds of the far west.

It was now afternoon. We rested near an old beaver-dam, caught a few trout for supper, and crossing the valley began the ascent on its further side. The point at which we recrossed the

stream was considerably lower than that by which we had made our way in the morning. But I had taken my bearings when we were clear of the timber, and had no doubt we should strike into our previous route. The ascent was steeper, rougher, and more impeded with fallen timber than anything we had yet come to. By the time we reached the summit the golden sunlight was playing in level beams among the tall pines of the crest, and we knew it would be dark in little more than an hour. Pushing on through the forest, our guide kept more and more toward the right hand, away from the line which I felt sure was that of my bearings from the mountain. We should have reached our camp, or at least the valley reaching to it, but there was no sign of either. Nothing all round us but a forest that was growing every minute darker and more hopeless. At last Dan, who would not admit that he had lost his way, consented, but with some show of reluctance, to wheel round to the left. Night was now descending fast. Here and there we emerged from the gloom of the pines into an open space where there had been a forest fire. Seen in the dim light of departing day, the tall trunks blackened by the fire, others bleached white by the loss of their scorched barks, rose up like a company of specters, swinging their gaunt arms against the sky, as if to warn us not to pass them into the darkness beyond. After such open intervals the forest, as we re-entered it, became more somber than ever. The trees seemed to close all around and over us. The fallen timber increased in confusion, the horses stumbled on, and we could no longer see to guide them. Reaching at last a little glade above which we could see the stars, we resolved to pass the night there. Dan took charge of the horses, and we groped our way to where we hoped to find water. Our search proved successful, and as we were tired and thirsty we drank heartily from some pools which we could not see, and only discovered by getting into them. On our return we found that Dan had kindled a fire, which was blazing and crackling merrily. This was nearly all the comfort that could be had in the circumstances. For we had no food with us except the trout caught in the afternoon, and no covering for the night save the saddle

cloths of the horses. There was no help for it, however; so the trout were duly roasted and eaten, and each donned his saddle-cloth as bed and bedding combined. Before long, however, it was evident that, choosing his fireplace in the dark, our guide had placed it in rather perilous proximity to a quantity of dried brushwood and fallen timber. And, indeed, before we could do anything to prevent them, the flames spread onward till a venerable pine caught fire, and was soon a sheet of coruscating fireworks. His neighbors followed his example, and in a few minutes it was evident that the forest was on fire. The flames rushed along the branches, mounting higher and higher far up into the lofty crests of the pines, whence showers of sparks flew out and fell in long lines through the profoundly calm air. Tree after tree joined the conflagration, till the reports of the exploding branches, the hiss of the leaping flames, and the crash of the falling firebrands, with the ghastly glare, that now died down almost to darkness and anon shot forth into renewed brightness, made sleep unwelcome even had it been willing to come. Fortunately the fire eventually spent its fury on the trees that stood round the open spot we had selected. It had died down before morning. The presence of so much heat around us did little to modify the cold of the night air, and our thin saddle-cloths were not of much more service. My friend and I huddled as close together as possible, and lay looking up at the quiet stars as they slowly sailed across our little space of sky, yet keeping an eye, too, on the progress of the conflagration, lest by any chance the flames should spread and surround us. The stones underneath us seemed somehow to grow harder and more prominent before morning. I got up more than once and removed an offending block, but its place was soon taken by another. At last the first faint blush of dawn appeared beyond the pine-tops. As soon as daylight returned, the horses, which had been laboring wearily all night to find a meal among the brushwood, were harnessed, and we resumed the march. It was a glorious morning. Not a breath of air was yet astir. Long wreaths of blue smoke from our conflagration lay at rest among the pine-trees, like streaks of cloud asleep on a mountain. We followed the same

line that we had been pursuing when darkness came down the evening before. We had gone scarcely half a mile when we found ourselves at the edge of an open valley, and there in front stood our tent, gleaming white in the morning sunlight.

ARCHIBALD GEIKIE, F.R.S., in *Macmillan's Magazine*.

ARTHUR PENRHYN STANLEY.

The materials for the life of Arthur Penrhyn Stanley have been left entirely in the hands of literary executors, who, for the present, can allow no reference to them. But I have been asked to tell from recollection, and from the scanty materials at my own disposal, what I remember of a cousin who was the most intimate friend of my childhood and boyhood, and whose life was long interwoven with my own.

There are few country places in England which possess such a singular charm as Alderley. All who have lived in it have loved it, and to the Stanley family it has ever presented the ideal of that which is most interesting and beautiful. There the usually flat pasture-lands of Cheshire rise suddenly into the rocky ridge of Alderley Edge, with its Holy Well under an overhanging cliff, its gnarled pine-trees, and its storm-beaten beacon-tower ready to give notice of an invasion, looking far over the green plain to the smoke of Stockport and Macclesfield, which indicates the presence of great towns on the horizon. Beautiful are the beech woods which clothe the western side of the Edge, and feather over mossy lawns to the mere, which receives a reflection of their gorgeous autumnal tints, softened by a blue haze on its still waters.

Beyond the mere and Lord Stanley's park, on the edge of the pasture-lands, are the church and its surroundings—a wonderfully harmonious group, encircled by trees, with the old timbered inn of "The Eagle and Child" at the corner of the lane which turns up to them. In later times the church itself has

undergone a certain amount of "restoration," but sixty years ago it was marvelously picturesque, its chancel mantled in ivy of massy folds, which, while they concealed the rather indifferent architecture, had a glory of their own very different to the clipped, ill-used ivy which we generally see on such buildings; but the old clock-tower, the outside stone staircase leading to the Park pew, the crowded groups of large square, lichen-stained gravestones, the disused font in the churchyard overhung by a yew-tree, and the gable-ended school-house at the gate, built of red sandstone, with gray copings and mullioned windows, were the same.

Close by was the rectory, with its garden—the "Dutch Garden," of many labyrinthine flower-beds—joining the churchyard. A low house, with a veranda, forming a wide balcony for the upper story, where bird-cages hung amongst the roses; its rooms and passages filled with pictures, books, and the old carved oak furniture, usually little sought or valued in those days, but which the rector delighted to pick up amongst his cottages.

This rector, Edward Stanley, younger brother of the Sir John who was living at the Park, was a little man, active in figure and in movement, with dark, piercing eyes, rendered more remarkable by the snow-white hair which was his characteristic even when very young. With the liveliest interest on all subjects—political, philosophical, scientific, theological; with inexhaustible plans for the good of the human race in general, but especially for the benefit of his parishioners and the amusement of his seven nieces at the Park, he was the most popular character in the country-side. To children he was indescribably delightful. There was nothing that he was not supposed to know—and indeed who was there who knew more?—of insect life, of the ways and habits of birds, of fossils and where to find them, of drawing, of etching on wood and lithographing on stone, of plants and gardens, of the construction of ships and boats, and of the thousand home manufactures of which he was a complete master.

In his thirty-first year Edward Stanley had married Catherine, eldest daughter of Oswald Leicester, afterward rector of Stoke-

upon-Terne, of an old Cheshire family, which, through many generations, had been linked with that of the Stanleys in the intimacy of friendship and neighborhood, for Toft, the old seat of the Leycesters and the pleasantest of family homes, was only a few miles from Alderley.

At the time of her engagement Catherine Leycester was only sixteen, and eighteen at the time of her marriage, but from childhood she had been accustomed to form her own character by thinking, reading, and digesting what she read. Owing to her mother's ill-health she had very early in life had the responsibility of educating and training her sister, who was much younger than herself. She was the best of listeners, fixing her eyes upon the speaker, but saying little herself, so that her old uncle, Hugh Leycester, used to assert of her, "Kitty has much sterling gold, but gives no ready change." To the frivolity of an ordinary acquaintance, her mental superiority and absolute self-possession of manner must always have made her somewhat alarming; but those who had the opportunity of penetrating beneath the surface were no less astonished at her originality and freshness of ideas, and her keen though quiet enjoyment of life, its pursuits and friendships, than by the calm wisdom of her advice, and her power of penetration into the characters, and consequently the temptations and difficulties, of others.

In the happy home of Alderley rectory her five children were brought up. Her eldest son, Owen, had from the first shown that interest in all things relating to ships and naval affairs which had been his father's natural inclination in early life; and the youngest, Charles, from an early age had turned his hopes to the profession of a royal engineer, in which he afterward became distinguished. Arthur, the second boy, born December 13, 1815, was always delicate—so delicate that it was scarcely hoped at first he would live to grow up. From his earliest childhood, his passion for poetry and historical studies of every kind gave promise of a literary career, and engaged his mother's unwearied interest in the formation of his mind and character. A pleasant glimpse of the home-life at Alderley

in May, 1818, is given in a letter from Mrs. Stanley to her sister, Maria Leicester:—

How I have enjoyed these fine days,—and one's pleasure is doubled, or rather I should say trebled, in the enjoyment of the three little children basking in the sunshine on the lawns and picking up daisies and finding new flowers every day,—and in seeing Arthur expand like one of the flowers in the fine weather. Owen trots away to school at nine o'clock every morning, with his Latin grammar under his arm, leaving Mary with a strict charge to unfurl his flag, which he leaves carefully furled, through the little Gothic gate, as soon as the clock strikes twelve. So Mary unfurls the flag and then watches till Owen comes in sight, and as soon as he spies her signal, he sets off full gallop toward it, and Mary creeps through the gate to meet him, and then comes with as much joy to announce Owen's being come back as if he were returned from the north pole. Meanwhile I am sitting with the doors open into the trellis, so that I can see and hear all that passes.

In the same year, after an absence, Mrs. Stanley wrote:—

ALDERLEY, Sept. 14, 1818.—What happy work it was getting home! The little things were as happy to see us as we could desire. They all came dancing out, and clung round me, and kissed me by turns, and were certainly more delighted than they had ever been before to see us again. They had not only not forgot us, but not forgot a bit about us. Everything that we had done and said and written was quite fresh and present to their minds, and I should be assured in vain that all my trouble in writing to them was thrown away. Arthur is grown so interesting, and so entertaining too,—he talks incessantly, runs about, and amuses himself, and is full of pretty speeches, repartees, and intelligence: the dear little creature would not leave me, or stir without holding my hand, and he knew all that had been going on quite as much as the others. He is more like Owen than ever, only softer, more affectionate, and not what you call "so fine a boy."

When he was four years old, we find his mother writing to her sister:—

January 30, 1820.—As for the children, my Arthur is sweeter than ever. His drawing fever goes on, and his passion for pictures and birds, and he will talk sentiment to mademoiselle about le printemps, les oiseaux, and les fleurs, when he walks out. When we went to Highlake, he asked—quite gravely—whether it would not be good for his little wooden horse to have some sea-bathing!

And again, in the following summer:—

ALDERLEY, July 6, 1820.—I have been taking a domestic walk with the three children and the pony to Owen's favorite cavern, Mary and Arthur taking it in turns to ride. Arthur was sorely puzzled between his fear and his curiosity. Owen and Mary, full of adventurous spirit, went with mademoiselle to explore. Arthur stayed with me and the pony, but when I said I would go, he said, coloring, he would go, he *thought*: "But, mamma, do you think there are any wild dogs in the cavern?" Then we picked up various specimens of cobalt, etc., and we carried them in a basket, and we called at Mrs. Barber's, and we got some string, and we tied the

basket to the pony with some trouble, and we got home very safe, and I finished the delights of the evening by reading "Paul and Virginia" to Owen and Mary, with which they were much delighted, and so was I.

You would have given a good deal for a peep at Arthur this evening, making hay with all his little strength—such a beautiful color, and such soft animation in his blue eyes.

It was often remarked that Mrs. Stanley's children were different from those of any one else; but this was not to be wondered at. Their mother not only taught them their lessons, she learned all their lessons with them. Whilst other children were plodding through dull histories of disconnected countries and ages, of which they were unutterably weary at the time, and of which they remembered nothing afterward, Mrs. Stanley's system was to take a particular era, and, upon the basis of its general history, to pick out for her children from different books, whether memoirs, chronicles, or poetry, all that bore upon it, making it at once an interesting study to herself and them, and talking it over with them in a way which encouraged them to form their own opinion upon it, to have theories as to how such and such evils might have been forestalled or amended, and so to fix it in their recollection.

To an imaginative child, Alderley was the most delightful place possible, and whilst Owen Stanley delighted in the clear brook which dashes through the rectory garden for the ships of his own manufacture—then as engrossing as the fitting out of the Ariel upon the mere in later boyhood—little Arthur reveled in the legends of the neighborhood—of its wizard of Alderley Edge, with a hundred horses sleeping in an enchanted cavern, and of the church-bell which fell down a steep hill into Rostherne Mere, and which is tolled by a mermaid when any member of a great neighboring family is going to die.

Being the poet of the little family, Arthur Stanley generally put his ideas into verse, and there are lines of his written, at eleven years old, on seeing the sunrise from the top of Alderley church tower, and at twelve years old, on witnessing the departure of the Ganges, bearing his brother Owen from Spithead, which give evidence of poetical power, more fully evinced two years later in his longer poems on "The Druids" and on "The

Maniac of Betharan." When he was old enough to go to school, his mother wrote an amusing account of the turn-out of his pockets and desk before leaving home, and the extraordinary collection of crumpled scraps of poetry which were found there. In March, 1821, Mrs. Stanley wrote:—

Arthur is in great spirits and looks, well prepared to do honor to the jacket and trousers preparing for him. He is just now opposite to me, lying on the sofa reading Miss Edgeworth's "Frank" to himself (his lesson being concluded) most eagerly. I must tell you his moral deductions from "Frank." The other day, as I was dressing, Arthur, Charlie, and Elizabeth were playing in the passage. I heard a great crash, which turned out to be Arthur running very fast, not stopping himself in time, and coming against the window, at the end of the passage, so as to break three panes. He was not hurt, but I heard Elizabeth remonstrating with him on the crime of breaking windows, to which he answered with great sang-froid, "Yes, but you know Frank's mother said she would rather have all the windows in the house broke than that Frank should tell a lie: so now I can go and tell mamma, and then I shall be like Frank." I did not make my appearance, so when the door opened for the entrée after dinner, Arthur came in first in something of a bustle, with cheeks as red as fire, and eyes looking—as his eyes do look,—saying, the instant the door opened, "Mamma! I have broke three panes of glass in the passage window!—and I tell you now 'cause I was afraid to forget." I am not sure whether there is not a very inadequate idea left on his mind as to the sin of glass-breaking, and that he rather thought it a fine thing having the opportunity of coming to tell mamma something like Frank; however, there was some little effort, *vide* the agitation and red cheeks, so we must not be hypercritical.

After he was eight years old, Mrs. Stanley, who knew the interest and capacity of her little Arthur about everything, was much troubled by his becoming so increasingly shy that he never would speak if he could help it, even when he was alone with her, and she dreaded that the companionship of other boys at school, instead of drawing him out, would only make him shut himself up more in himself. Still, in the frequent visits which his parents paid to the sea-side at Highlake, he always recovered his lost liveliness of manner and movement, climbed merrily up the sandhills, and was never tired in mind or body. It was therefore a special source of rejoicing when it was found that Mr. Rawson, the vicar of Seaforth (a place five miles from Liverpool, and only half a mile from the sea), had a school for nine little boys, and thither, in 1824, it was decided that Arthur should be sent. In August his young aunt wrote:—

Arthur liked the idea of going to school as making him approach nearer to Owen.

We took him last Sunday evening from Crosby, and he kept up very well till we were to part, but when he was to separate from us to join his new companions he clung to us in a piteous manner, and burst into tears. Mr. Rawson very good-naturedly offered to walk with us a little way, and walk back with Arthur, which he liked better, and he returned with Mr. R. very manfully. On Monday evening we went to have a look at him before leaving the neighborhood, and found the little fellow as happy as possible, much amused with the novelty of the situation, and talking of the boys' proceedings with as much importance as if he had been there for months. He wished us good-by in a very firm tone, and we have heard since from his uncle Penrhyn that he had been spending some hours with him, in which he laughed and talked incessantly of all that he did at school. He is very proud of being called "Stanley," and seems to like it altogether very much. The satisfaction to mamma and auntie is not to be told of having disposed of this little sylph in so excellent a manner. Every medical man has always said that a few years of constant sea-air would make him quite strong, and to find this united to so desirable a master as Mr. R., and so careful and kind a protectress as Mrs. R., is being very fortunate.

In the following summer the same pen writes from Alderley to one of the family:—

July, 1825.—You know how dearly I love all these children, and it has been such a pleasure to see them all so happy together. Owen, the hero upon whom all their little eyes were fixed, and the delicate Arthur able to take his own share of boyish amusements with them, and telling out his little store of literary wonders to Charlie and Catherine. School has not transformed him into a rough boy yet. He is a little less shy, but not much. He brought back from school a beautiful prize book for history, of which he is not a little proud; and Mr. Rawson has told several people, unconnected with the Stanleys, that he never had a more amiable, attentive, or clever boy than Arthur Stanley, and that he never has had to find fault with him since he came. My sister finds, in examining him, that he not only knows what he has learned himself, but that he picks up all the knowledge gained by the other boys in their lessons, and can tell what each boy in the school has read, etc. His delight in reading "Madoc" and "Thalaba" is excessive.

In the following year Miss Leycester writes:—

STOKE, August 26, 1826.—My Alderley children are more interesting than ever. Arthur is giving Mary quite a literary taste, and is the greatest advantage to her possible, for they are now quite inseparable companions, reading, drawing, and writing together. Arthur has written a poem on the life of a peacock-butterfly in the Spenserian stanza, with all the old words, with references to Chaucer, etc., at the bottom of the page! To be sure it would be singular if they were not different from other children, with the advantages they have where education is made so interesting and amusing as it is to them. . . . I never saw anything equal to Arthur's memory and quickness in picking up knowledge; seeming to have just the sort of intuitive sense of everything relating to books that Owen had in ships,—and then there is such affection and sweetness of disposition in him. . . . You will not be tired of all this detail of those so near my heart. It is always such a pleas-

ure to me to write of the rectory, and I can always do it better when I am away from it and it rises before my mental vision.

The summer of 1826 was marked for the Stanleys by the news of the death of their beloved friend Reginald Heber, and by the marriage of Isabella Stanley to Captain Parry, the arctic voyager, an event at which "his mother could not resist sending for her little Arthur to be present." Meantime he was happy at school, and wrote long histories home of all that took place there, especially amused with his drilling sergeant, who told him to "put on a bold, swaggering air, and not to look sheepish." But each time of his return to Alderley he seemed shyer than ever, and his mother became increasingly concerned at his want of boyishness.

January 27, 1828.—Oh, it is so difficult to know how to manage Arthur! He takes having to learn dancing so terribly to heart, and enacts Prince Pitiful; and will, I am afraid, do no good at it. Then he thinks I do not like his reading because I try to draw him also to other things, and so he reads by stealth and lays down his book when he hears people coming; and having no other pursuits or anything he cares for but reading, has a listless look, and I am sure he is very often unhappy. I suspect, however, that this is Arthur's worst time, and that he will be a happier man than boy.

In January, 1828, Mrs. Stanley wrote to Augustus W. Hare, long an intimate friend of the family, and soon about to marry her sister:—

I have Arthur at home, and I have rather a puzzling card to play with him—how not to encourage too much his poetical tastes, and to spoil him, in short—and yet how not to discourage what in reality one wishes to grow, and what he, being timid and shy to a degree, would easily be led to shut up entirely to himself; and then he suffers so much from a laudable desire to be with other boys, and yet when with them, finds his incapacity to enter into their pleasures of shooting, hunting, horses, and theirs for his. He will be happier as a man, as literary men are more within reach than literary boys.

In the following month she wrote:—

ALDERLEY, February 8, 1828.—Now I am going to ask your opinion and advice, and perhaps your assistance, on my own account. We are beginning to consider what is to be done with Arthur, and it will be time for him to be moved from his small school in another year, when he will be thirteen. We have given up all thoughts of Eton for him from the many objections, combined with the great expense. Now I want to ask your opinion about Shrewsbury, Rugby, and Winchester; do you think, from what you know of Arthur's character and capabilities, that Winchester would suit him, and vice versa?

In answer to this Augustus Hare wrote to her from Naples :—

March 26, 1828.—Are you aware that the person of all others fitted to get on with boys is just elected master of Rugby? His name is Arnold. He is a Wykehamist and Fellow of Oriel, and a particular friend of mine—a man calculated beyond all others to engraft modern scholarship and modern improvements on the old-fashioned stem of a public education. Winchester under him would be the best school in Europe; what Rugby may turn out I cannot say, for I know not the materials he has there to work on.

A few weeks later he added :—

FLORENCE, April 19, 1828.—I am so little satisfied with what I said about Arthur in my last letter, that I am determined to begin with him and do him more justice. What you describe him now to be, I once was; and I have myself suffered too much and too often from my inferiority in strength and activity to boys who were superior to me in nothing else, not to feel very deeply for any one in a similar state of school-forwardness and bodily weakness. Parents in general are too anxious to push their children on in school and other learning. If a boy happens not to be robust, it is laying up for him a great deal of pain and mortification. For a boy must naturally associate with others in the same class: and consequently, if he happens to be forward beyond his years, he is thrown at twelve (with perhaps the strength of only eleven or ten) into the company of boys two years older and probably three or four years stronger (for boobies are always stout of limb). You may conceive what wretchedness this is likely to lead to, in a state of society like a school, where might almost necessarily makes right. But it is not only at school that such things lead to mortification. There are a certain number of manly exercises which every gentleman, at some time or other of his life, is likely to be called on to perform, and many a man who is deficient in these would gladly purchase dexterity in them, if he could, at the price of those mental accomplishments which have cost him in boyhood the most pains to acquire. Who would not rather ride well at twenty-five than write the prettiest Latin verses? I am perfectly impartial in this respect, being able to do neither, and therefore my judgment is likely enough to be correct. So pray during the holidays make Arthur ride hard and shoot often, and, in short, gymnasticize in every possible manner. I have said thus much to relieve my own mind, and convey to you how earnestly I feel on the subject. Otherwise I know Alderley and its inhabitants too well to suspect any one of them of being what Wordsworth calls "an intellectual all-in-all." About his school, were Rugby under any other master, I certainly should not advise your thinking of it for Arthur for an instant; as it is, the decision will be more difficult. When Arnold has been there ten years, he will have made it a good school, perhaps in some respects the very best in the island; but a transition state is always one of doubt and delicacy. Winchester is admirable for those it succeeds with, but it is not adapted for all sorts and conditions of boys, and sometimes fails. However, when I come to England, I will make a point of seeing Arthur, when I shall be a little better able perhaps to judge.

In the summer of 1828 Mr. and Mrs. Stanley, with her sister Maria and her niece Lucy Stanley, from the Park, went by sea

to Bordeaux and for a tour in the Pyrenees, taking little Arthur and his sister Mary with them. It was his first experience of foreign travel, and most intense was his enjoyment of it. All was new then, and Mr. Stanley wrote of the children as being almost as much intoxicated with delight on first landing at Bordeaux as their faithful maid, Sarah Burgess, who "thinks life's fitful dream is past, and that she has, by course of transmigration, passed into a higher sphere." It is recollected how, when he first saw the majestic summit of the Pic du Midi rising above a mass of cloud, Arthur Stanley, in his great ecstasy, could say nothing but "What shall I do! What shall I do!"

In the following October Mrs. Stanley described her boy's peculiarities to Dr. Arnold, and asked his candid advice as to how far Rugby was likely to suit him. After receiving his answer she wrote to her sister:—

October 10, 1828.—Dr. Arnold's letter has decided us about Arthur. I should think there was not another schoolmaster in his Majesty's dominions who would write such a letter. It is so lively, agreeable, and promising in all ways. He is just the man to take a fancy to Arthur, and for Arthur to take a fancy to.

It was just as his mother had foreseen. Arthur Stanley went to Rugby in the following January, and was immediately captivated by his new master. His parents visited him two months afterward as they were returning from Cheshire to London. Mrs. Stanley wrote to her sister:—

March, 1829.—We arrived at Rugby exactly at twelve, waited to see the boys pass, and soon spied Arthur with his books on his shoulder. He colored up and came in, looking very well, but cried a good deal on seeing us, chiefly I think from nervousness. The only complaint he had to make was that of having no friend, and the feeling of loneliness belonging to that want, and this, considering what he is and what boys of his age usually are, would and must be the case anywhere. We went to dine with Dr. and Mrs. Arnold, and they are of the same opinion, that he was as well off and as happy as he could be at a public school, and on the whole I am satisfied—quite satisfied considering all things, for Dr. and Mrs. Arnold are indeed delightful. She was ill, but still animated and lively. He has a very remarkable countenance, something in forehead, and again in manner, which puts me in mind of Reginald Heber, and there is a mixture of zeal, energy, and determination tempered with wisdom, candor, and benevolence, both in manner and in everything he says. He had examined Arthur's class, and said Arthur had done very well, and the class generally. He said he was gradually reforming, but that it was like pasting down a piece of paper—as fast as one corner was put down another started up.

"Yes," said Mrs. A., "but Dr. Arnold always thinks the corner will not start *again*." And it is that happy sanguine temperament which is so particularly calculated to do well in this or, indeed, any situation.

Arthur Stanley soon became very happy at Rugby. His want of a friend was speedily supplied, and many of the friends of his whole after-life dated from his early school-days, especially Charles Vaughan, afterward his intimate companion, eventually his brother-in-law. His rapid removal into the shell at Easter, and into the fifth form at midsummer, brought him nearer to the head master, at the same time freeing him from the terrors of prepostors and fagging, and giving him entrance to the library. So he returned to Alderley in the summer holidays well and prosperous, speaking out, and full of peace and happiness, ready to enjoy "striding about upon the lawn on stilts" with his brother and sisters. On his return to school his mother continued to hear of his progress in learning, but derived even more pleasure from his accounts of football, and of a hare-and-hounds hunt in which he "got left behind with a clumsy boy and a silly one" at a brook, which, after some deliberation, he leapt, and "nothing happened."

In September, 1829, his mother writes:—

I have had such a ridiculous account from Arthur of his sitting up, with three others, all night, to see what it was like! They heartily wished themselves in bed before morning. He also writes of an English copy of verses given to the fifth form—Brownsover, a village near Rugby, with the Avon flowing through it and the Swift flowing into the Avon, into which Wickliffe's ashes were thrown. So Arthur and some others instantly made a pilgrimage to Brownsover to make discoveries. They were allowed four days, and Arthur's was the best of the thirty in the fifth form, greatly to his astonishment, but, he says, "Nothing happened, except that I get called Poet now and then, and my study, Poet's Corner." The master of the form gave another subject for them to write upon in an hour to see if they had each made their own, and Arthur was again head. What good sense there is in giving these kind of subjects to excite interest and inquiry, though few would be so supremely happy as Arthur in making the voyage of discovery. I ought to mention that Arthur was detected with the other boys in an unlawful letting off of squibs, and had 100 lines of Horace to translate!

The following gleanings from his mother's letters give, in the absence of other material, glimpses of Arthur Stanley's life during the next few years:—

February 22, 1830.—Arthur writes me word he has begun mathematics, and does

not wonder Archimedes never heard the soldiers come in if he was as much puzzled over a problem as he is.

June 1, 1830.—We got to Rugby at eight, fetched Arthur, to his great delight and surprise, and had two most comfortable hours with him. There is just a shade more of confidence in his manners which is very becoming. He talked freely and fluently, looked well and happy, and came the next morning at six o'clock with his Greek book and his note-book under his arm.

June 22, 1830.—There was a letter from Arthur on Monday saying that his verses on Malta had failed in getting the prize. There had been a hard contest between him and another. His poem was the longest and contained the best ideas, but he says "that is matter of opinion;" the other was the most accurate. There were three masters on each side, and it was some time in being decided. The letter expresses his disappointment (for he had thought he should have it), his vexation (knowing that another hour would have enabled him to look over and probably to correct the fatal faults) so naturally, and then the struggle of his amiable feeling that it would be unkind to the other boy, who had been very much disappointed not to get the essay, to make any excuses. Altogether it is just as I should wish, and much better than if he had got it.

July 20, 1830.—Arthur came yesterday. He begins to look like a young man.

December, 1830.—Arthur has brought home a letter from Mrs. Arnold to say that she could not resist sending me her congratulations on his having received the remarkable distinction of not being examined at all except in extra subjects. Dr. Arnold called him up before masters and school, and said he had done so perfectly well it was useless.

December 30, 1830.—I was so amused the other day taking up the memorandum-books of my two boys. Owen's full of calculations, altitudes, astronomical axioms, etc. Arthur's of Greek idioms, Grecian history, parallels of different historical situations. Owen does Arthur a great deal of good by being so much more attentive and civil; it piques him to be more alert. Charlie profits by both brothers. Arthur examines him in his Latin, and Charlie sits with his arm round his neck, looking with the most profound deference in his face for exposition of Virgil.

February, 1831.—Charlie writes word from school: "I am very miserable, not that I want anything, except to be at home." Arthur does not mind going half so much. He says he does not know why, but all the boys seem fond of him, and he never gets plagued in any way like the others; his study is left untouched, his things unbroke, his books undisturbed. Charlie is so fond of him and deservedly so. You would have been so pleased one night, when Charlie all of a sudden burst into violent distress at not having finished his French task for the holidays, by Arthur's judicious good-nature in showing him how to help himself, entirely leaving what he was about of his own employment.

July, 1831.—I am writing in the midst of an academy of art. Just now there are Arthur and Mary drawing and painting at one table; Charlie deep in the study of fishes and hooks, and drawing varieties of both at another; and Catherine with her slate full of houses with thousands of windows. Charlie is fishing mad, and knows how to catch every sort, and just now he informs me that to catch a bream you must go out before breakfast. He is just as fond as ever of Arthur. You would like to see Arthur examine him, which he does so mildly and yet so strictly, explaining everything so à l'Arnold.

July 17, 1831.—I have been busy teaching Arthur to drive, row, and gymnasticeze,

and he finds himself making progress in the latter ; that he can do more as he goes on—a great encouragement always. Imagine Dr. Arnold and one of the other masters gymnasticizing in the garden, and sometimes going out leaping—as much a sign of the times as the chancellor appearing without a wig, and the king with half a coronation.

ALDERLEY, November 11.—We slept at Rugby on Monday night, had a comfortable evening with Arthur, and next morning breakfasted with Dr. Arnold. What a man he is ! He struck me more than before, even, with the impression of power, energy, and singleness of heart, aim, and purpose. He was very indignant at the Quarterly Review article on cholera—the surpassing selfishness of it, and spoke so nobly—was busy writing a paper to state what cholera is, and what it is not. . . . Arthur's veneration for him is beautiful ; what good it must do to grow up under such a tree !

December 22, 1831.—I brought Arthur home on Wednesday from Knutsford. He was classed first in everything but composition, in which he was second, and mathematics, in which he did not do well enough to be classed, nor ill enough to prevent his having the reward of the rest of his works. I can trace the improvement from his having been so much under Dr. Arnold's influence ; so many inquiries and ideas are started in his mind which will be the groundwork of future study.

. . . Charlie is very happy now in the thought of going to Rugby and being with Arthur, and Arthur has settled all the study and room concerns very well for him. I am going to have a sergeant from Macclesfield to drill them these holidays, to Charlie's great delight and Arthur's patient endurance. The latter wants it much. It is very hard always to be obliged to urge that which is against the grain. I never feel I am doing my duty so well to Arthur as when I am teaching him to dance, and urging him to gymnasticize, when I would so much rather be talking to him of his note-books, etc. He increasingly needs the free use of his powers of mind, too, as well as of his body. The embarrassments and difficulty of getting out what he knows seems so painful to him, while some people's pain is all in getting it in ; but it is very useful for him to have drawbacks in everything.

May 22, 1832.—We got such a treat on Friday evening in Arthur's parcel of prizes. One copy he had illustrated, in answer to my questions, with all his authorities, to show how he came by the various bits of information. In this parcel he sent "An Ancient Ballad, showing how Harold the King died at Chester," the result of a diligent collation of old chronicles he and Mary had made together in the winter. Arthur put all the facts together from memory.

Dec. 26, 1832.—Arthur and Charlie came home on Wednesday. Arthur has not shaken off his first fit of shyness yet. I think he colors more than ever, and hesitates more in bringing out what he has to say. I am at my usual work of teaching him to use his body, and Charlie his mind.

April 13, 1833.—I never found Arthur more blooming than when we saw him at Rugby on Monday. Mrs. Arnold said she always felt that Arthur had more sympathy with her than any one else, that he understood and appreciated Dr. Arnold's character, and the union of strength and tenderness in it, that Dr. A. said he always felt that Arthur took in his ideas, received all he wished to put into him more in the true spirit and meaning than any boy he had ever met with, and that she always delighted in watching his countenance when Dr. Arnold was preaching.

July, 1833.—At eight o'clock last night the Arnolds arrived. Dr. Arnold and Arthur behind the carriage, Mrs. Arnold and two children inside, two more with

the servant in front, having left the other chaiseful at Congleton. Arthur was delighted with his journey,—said Dr. Arnold was just like a boy—jumped up, delighted to be set free,—had talked all the way of the geology of the country, knowing every step of it by heart,—so pleased to see a common, thinking it might do for the people to expatiate on. We talked of the Cambridge philosophers—why he did not go there—he dared not trust himself with its excitement or with society in London. Edward said something of the humility of finding yourself with people so much your superior, and at the same time the elevation of feeling yourself of the same species. He shook his head—"I should feel that in the company of legislators, but not of abstract philosophers." Then Mrs. Arnold went on to say how De Ville had pronounced on his head that he was fond of facts, but not of abstractions, and he allowed it was most true; he liked geology, botany, philosophy, only as they are connected with the history and well-being of the human race. . . . The other chaise came after breakfast. He ordered all into their places with such a gentle decision, and they were all off by ten, having ascertained, I hope, that it was quite worth while to halt here even for so short a time.

It was in November, 1833, that Arthur Stanley went to Oxford to try for the Balliol Scholarship, and gained the first scholarship against thirty competitors. The examination was one especially calculated to show the wide range of Arnold's education. Stanley wrote from Oxford to his family:—

November 26, 1833.—On Monday our examination began at 10 A.M. and lasted to 4 P.M.—a Latin theme, which, as far as four or five revisals could make sure, was without mistakes, and satisfied me pretty well. In the evening we went in from 7 P.M. till 10 and had a Greek chorus to be translated with notes and also turned into Latin verses which I did not do well. On Tuesday from 10 to 1 we had an English theme and a criticism on Virgil which I did pretty well, and Greek verses from 2 to 4—middling, and we are to go in again to-night at 9. I cannot the least say if I am likely to get it. There seem to be three formidable competitors, especially one from Eton.

Friday, November 29, 7½ P.M.—I will begin my letter in the midst of my agony of expectation and fear. I finished my examination to-day at 2 o'clock. At 8 to-night the decision takes place, so that my next ½ of an hour will be dreadful. As I do not know how the other schools have done, my hope of success can depend upon nothing, except that I think I have done pretty well, better perhaps from comparing notes than the rest of the Rugby men. Oh, the joy if I do get it! and the disappointment if I do not. And from two of us trying at once, I fear the blow to the school would be dreadful if none of us get it. We had to work the second day as hard as on the first, on the third and fourth not so hard, nor to-day—Horace to turn into English verse, which was good for me; a divinity and mathematical paper, in which I hope my copiousness in the first made up for my scantiness in the second. Last night I dined at Magdalen, which is enough of itself to turn one's head upside down, so very magnificent. . . . I will go on now. We all assembled in the hall and had to wait an hour, the room getting fuller and fuller with Rugby Oxonians crowding in to hear the result. Every time the door opened, my heart jumped, but many times it was nothing. At last the Dean appeared in his white robes and

moved up to the head of the table. He began a long preamble—that they were well satisfied with all, and that those who were disappointed were many in comparison with those who were successful, etc. All this time every one was listening with the most intense eagerness, and I almost bit my lips off till—"The successful candidates are—Mr. Stanley"—I gave a great jump, and there was a half shout amongst the Rugby men. The next was Lonsdale from Eton. The Dean then took me into the chapel where the Master and all the Fellows were, and there I swore that I would not reveal the secrets, disobey the statutes, or dissipate the wealth of the college. I was then made to kneel on the steps and admitted to the rank of Scholar and Exhibitioner of Balliol College, "*nomine Patris, Filii, et Spiritus.*" I then wrote my name, and it was finished. We start to-day in a chaise and four for the glory of it. You may think of my joy, the honor of Rugby is saved, and I am a scholar of Balliol!"

Dr. Arnold wrote to Mrs. Stanley:—

I do heartily congratulate you and heartily thank Arthur for the credit and real benefit he has conferred on us. There was a feeling abroad that we could not compete with Eton or the other great schools in the contest for university honors, and I think there was something of this even in the minds of my own pupils, however much they might value my instruction in other respects, and those who wish the school ill for my sake were ready to say that the boys were taught politics and not taught to be scholars. Already has the effect of Arthur's success been felt here in the encouragement which it has given to others to work hard in the hope of treading in his steps, and in the confidence it has given them in my system. And yet, to say the truth, though I do think that with God's blessing I have been useful to your son, yet his success on this occasion is all his own, and a hundred times more gratifying than if it had been gained by my examining. For I have no doubt that he gained his scholarship chiefly by the talent and good sense of his compositions, which are, as you know, very remarkable.

Arthur Stanley remained at Rugby till the following summer, gaining more now, he considered, from Dr. Arnold than at any other time, though his uncle, Augustus Hare, who had been applied to, discouraged his being left at school so long, because "though most boys learn most during their last year, it is when they are all shooting up together, but Arthur must be left a high tree among shrubs." Of this time are the following letters from Mrs. Stanley:—

February 3, 1834.—I have just lost Arthur, and a great loss he is to me. The latter part of his time at home is always so much the most agreeable, he gets over his reserve so much more. He has been translating and retranslating Cicero for his improvement, and has been deep in Guizot's essay on the Civilization of Europe, besides being chiefly engaged in a grand work, at present a secret, but of which you may perhaps hear more in the course of the spring. I have generally sate with him or he with me, to be ready with criticisms when wanted, and it is delightful to

be so immediately and entirely understood—the why and wherefore of an objection seen before it is said. And the mind is so logical, so clear, the taste so pure in all senses, and so accurate. He goes on so quietly and perseveringly as to get through all he intends to get through without the least appearance of bustle or business. He finished his studies at home, I think, with an analysis of the Peninsular battles, trying to understand thereby the pro and con of a battle.

May 21, 1834.—I have taken the opportunity of spending Sunday at Rugby. Arthur met us two miles on the road, and almost his first words were how disappointed he was that Dr. Arnold had influenza, and would not be able to preach! However, I had the compensation of more of his company than under any other circumstances. There were only he and Mrs. Arnold, so that I became more acquainted with both, and altogether it was most interesting. We had the Sunday evening chapter and hymn, and it was very beautiful to see his manner to the little ones, indeed to all. Arthur was quite as happy as I was to have such an uninterrupted bit of Dr. Arnold—he talks more freely to him a great deal than he does at home.

The spring of 1834 had been saddened to the Stanleys by the death of Augustus Hare at Rome; and the decision of his widow—the beloved “Auntie” of Arthur Stanley’s childhood—to make Hurstmonceaux her home, led to his being sent, before going to Oxford, for a few months as a pupil to Julius Hare, who was then rector of Hurstmonceaux. Those who remember the enthusiastic character of Julius Hare, his energy in what he undertook, and his vigorous though lengthy elucidation of what he wished to explain, will imagine how he delighted in reopening for Arthur Stanley the stores of classical learning which had seemed laid aside forever in the solitude of his Sussex living. “I cannot speak of the blessing it has been to have Arthur so long with you,” his mother wrote afterward. “He says he feels his mind’s horizon so enlarged, and that a foundation is laid of interest and affection for Hurstmonceaux, which he will always henceforward consider as ‘one of his homes, one of the many places in the world he has to be happy in.’ He writes happily from Oxford, but the lectures and sermons there do not go down after the food he has been living on at Hurstmonceaux and Rugby.”

In this brief sketch we do not dwell upon Arthur Stanley’s happy and successful career at college, upon his many prizes, his honors of every kind,* even upon his Newdigate poem of

* The Ireland Scholarship and a First Class in Classics, 1837; the Chancellor’s Latin Prize Essay, 1839; the English Essay, 1840, etc.

"The Gypsies," which his father heard him deliver in the Sheldonian Theater, and burst into tears amid the tumult and applause which followed. It may truly be said of him that he "applied his heart to know, and to search, and to seek out wisdom."

In the autumn of 1839 Arthur Stanley was ordained, though full of mental difficulties as to subscription. He was decided by a letter from Arnold, who urged that his own difficulties of the same kind had gradually decreased in importance; that he had long been persuaded that subscription to the letter to any amount of human propositions was impossible, and that the door of ordination was never meant to be closed against all but those whose "dull minds and dull consciences" could see no difficulty. In deciding to remain at Oxford, as a tutor at University College, where he had obtained a fellowship, Stanley believed that his ordination vows might be as effectually carried out by making the most of his vocation at college, and endeavoring to influence all who came within his sphere, as by undertaking any parochial cure. To his aunt, who remonstrated, he wrote:—

February 15, 1840.—I have never properly thanked you for your letters about my ordination, which I assure you, however, that I have not the less valued, and shall be no less anxious to try, as far as in me lies, to observe. It is, perhaps, an unfortunate thing for me, though as far as I see unavoidable, that the overwhelming considerations, immediately at the time of ordination, were not difficulties of practice, but of subscription, and the effect has been that I would always rather look back to what I felt to be my duty before that cloud came on, than to the time itself. Practically, however, I think it will in the end make no difference. The real thing which long ago moved me to wish to go into Orders, and which, had I not gone into Orders, I should have acted on as well as I could without Orders, was the fact that God seemed to have given me gifts more fitting me for Orders, and for that particular line of clerical duty which I have chosen, than for any other. It is perhaps as well to say that until I see a calling to other clerical work, as distinct as that by which I feel called to my present work, I should not think it right to engage in any other; but I hope I shall always feel, though I am afraid I cannot be too constantly reminded, that in whatever work I am engaged now, or hereafter, my great end ought always to be the good of the souls of others, and my great support the good which God will give to my own soul.

Two years before this, in 1837, the Rector of Alderley had been appointed to the Bishopric of Norwich, and had left Cheshire amidst an uncontrollable outburst of grief from the people,

amongst whom he had lived as a friend and a father for thirty-two years. Henceforward, the scientific pursuits which had occupied his leisure hours at Alderley were laid aside in the no-leisure of his devotion to the See with whose interests he now identified his existence. His one object seemed to be to fit himself more completely for dealing with ecclesiastical subjects, by gaining a clearer insight into clerical duties and difficulties, and, though he long found his diocese a bed of thorns, his kindly spirit, his broad liberality, and all-embracing fatherly sympathy, never failed to leave peace behind them. His employments were changed, but his characteristics were the same; the geniality and simplicity shown in dealing with his clergy, and his candidates for ordination, had the same power of winning hearts which was evinced in his relation to the cottagers at Alderley; and the same dauntless courage which would have been such an advantage in commanding the ship he longed for in his youth, enabled him to face Chartist mobs with composure, and to read unmoved the many party censures which followed such acts as his public recognition in Norwich Cathedral of the worth of Joseph Gurney, the Quaker philanthropist; his appearance on a platform, side by side with the Irish priest, Father Matthew, advocating the same cause; and his enthusiastic friendship for Jenny Lind, who on his invitation made the palace her home during her stay in Norwich.

Most delightful, and very different from the modern building which has partially replaced it, was the old palace at Norwich. Approached through a stately gateway, and surrounded by lawns and flowers, amid which stood a beautiful ruin, the old house with its broad old-fashioned staircase and vaulted kitchen, its beautiful library looking out to Mousehold and Kett's Castle, its great dining-room hung with pictures of the Nine Muses, its picturesque and curious corners, and its quaint and intricate passages, was indescribably charming. In a little side-garden under the cathedral, pet pee-wits and a raven were kept, which always came to the dining-room window at breakfast to be fed out of the Bishop's own hand—the only relic of his once beloved ornithological, as occasional happy excursions with a

little nephew to Bramerton in search of fossils, were the only trace left of his former geological pursuits.

"I live for my children, and for them alone I wish to live, unless in God's providence I can live to His glory," were Bishop Stanley's own words not many months before his death. He followed with longing interest the voyages of his son Owen as commander in the *Britomart*, and captain of the *Rattlesnake*, and rejoiced in the successful career of his youngest son Charles. These were, perhaps, the most naturally congenial to their father, and more of companions to him when at home than any of his other children. But in the last years of his life he was even prouder of his second son Arthur. The wonderful descriptive power and classical knowledge of his (unpublished) letters from Greece, had given his family a foretaste of what the world received twelve years later in "*Sinai and Palestine*," and, in 1844, was published that *Life of Dr. Arnold* (whose funeral sermon he had been selected to preach in 1842), which has translated his character to the world, and given him a wider influence since his death than he ever attained in his life. Perhaps, of all Stanley's books, *Arnold's Life* is still the one by which he is best known, and this, in his reverent love for his master, to whom he owed the building up of his mind, is as he would have wished it to be.

For twelve years, Arthur Stanley resided at University College, as fellow and tutor, undertaking also in the latter part of the time, the laborious duties of secretary to the University Commission, into which he threw himself with characteristic ardor. In 1845 he was appointed Select Preacher to the university, an office resulting in the publication of those "*Sermons and Essays on the Apostolic Age*," in which he especially endeavored to exhibit the individual human character of the different apostles.

The year 1849 was marked by the death of Bishop Stanley, which occurred during a visit to Brahan Castle in Scotland. Arthur was with him in his last hours, and brought his mother and sisters back to the desolate Norwich home, where a vast multitude attended the burial of the bishop in the cathedral. "I can give you the facts," wrote one who was present, "but I

can give you no notion of how impressive it was, nor how affecting. There were such sobs and tears from the school-children and from the clergy who so loved their dear bishop. A beautiful sunshine lit up everything, shining into the cathedral just at the time. Arthur was quite calm, and looked like an angel, with a sister on each side."

From the time of his father's death, from the time when he first took his seat at family prayers in the purple chair where the venerable white head was accustomed to be seen, Arthur Stanley seemed utterly to throw off all the shyness and embarrassment which had formerly oppressed him, to rouse himself by a great effort, and henceforward to forget his own personality altogether in his position and his work. His social and conversational powers, afterwards so great, increased perceptibly from this time.

It was two days after Mrs. Stanley left Norwich that she received the news of the death of her youngest son Charles in Van Diemen's Land; and a very few months only elapsed before she learned that her eldest son Owen had only lived to hear of the loss of his father. Henceforward his mother, saddened though not crushed by her triple grief, was more than ever Arthur Stanley's care: he made her the sharer of all his thoughts, the confidante of all his difficulties, all that he wrote was read to her before its publication, and her advice was not only sought but taken. In her new home in London he made her feel that she had still as much to interest her and give a zest to life as in the happiest days at Alderley and Norwich; most of all he pleased her by showing in the publication of the "Memoir of Bishop Stanley," in 1850, his thorough inward appreciation of the father with whom his outward intercourse had been of a less intimate kind than with herself.

In 1851 Arthur Stanley was presented to a canonry at Canterbury, which, though he accepted it with reluctance, proved to be an appointment entirely after his own heart, giving him leisure to write "Sinai and Palestine," and to complete his "Commentary on the Corinthians," and leading naturally to the "Historical Memorials of Canterbury," which, of all his books, was perhaps

the one which it gave him most pleasure to write. At Canterbury he not only lived amongst the illustrious dead, but he made them rise into new life by the way in which he spoke and wrote of them. Often on the anniversary of Becket's murder, as the fatal hour—five o'clock on a winter's afternoon—drew near, Stanley would marshal his family and friends round the scenes of the event, stopping with thrilling effect at each spot connected with it—"Here the knights came into the cloister—here the monks knocked furiously for refuge in the church"—till, when at length the chapel of the martyrdom was reached, as the last shades of twilight gathered amid the arches, the whole scene became so real that, with almost more than a thrill of horror, one saw the last moments through one's ears—the struggle between Fitzurse and the archbishop, the blow of Tracy, the solemn dignity of the actual death.

Stanley had a real pride in Canterbury. In his own words, he "rejoiced that he was the servant and minister, not of some obscure fugitive establishment, for which no one cares beyond his narrow circle, but of a cathedral whose name commands respect and interest even in the remotest parts of Europe." In his inaugural lectures as professor at Oxford, in speaking of the august trophies of ecclesiastical history in England, he said, "I need name but one, the most striking and obvious instance, the cradle of English Christianity, the seat of the English primacy, my own proud cathedral, the metropolitan church of Canterbury."

Those who remember Stanley's happy intercourse with his mother at Canterbury; his friendships in the place, especially with Archdeacon and Mrs. Harrison, who lived next door, and with whom he had many daily meetings and communications on all subjects; his pleasure in the preparation and publication of his "Canterbury Sermons;" his delightful home under the shadow of the cathedral, connected by the Brick Walk with the cloisters; and his constant work of a most congenial kind, will hardly doubt that in many respects the years spent at Canterbury were the most prosperous of his life. Vividly does the recollection of those who were frequently his guests go back to the afternoons when, his cathedral duties and writings being over,

he would rush out to Harbledown, to Patrixbourne, or along the dreary Dover road (which he always insisted upon thinking most delightful) to visit his friend Mrs. Gregory, going faster and faster as he talked more enthusiastically, calling up fresh topics out of the wealthy past. Or there were longer excursions to Bozendeane Wood, with its memories of the strange story of the so-called Sir William Courtenay, its blood-stained dingle amid the hazels, its trees riddled with shot, and its wide view over the forest of Blean to the sea, with the Isle of Sheppey breaking the blue waters.

Close behind Stanley's house was the Deanery and its garden, where the venerable Dean Lyall used daily at that time to be seen walking up and down in the sun. Here grew the marvelous old mulberry, to preserve the life of which, when failing, a bullock was effectually killed that the tree might drink in new life from its blood. A huge bough, which had been torn off from this tree, had taken root and had become far more flourishing than its parent. Arthur Stanley called them the Church of Rome and the Church of England, and gave a lecture about it in the town.

His power of calling up past scenes of history, painting them in words, and throwing his whole heart into them, often enacting them, made traveling with Arthur Stanley delightful. His mother, his sister Mary, his cousin Miss Penrhyn, and his friend Hugh Pearson, usually made up the summer party. For several years their tours were confined to France and Germany, Switzerland and Northern Italy. But in 1852 the family went for several months to Italy, seeing its northern and eastern provinces, in those happy days of vetturino traveling, as they will never be seen again, studying the story of its old towns, and eventually reaching Rome, which Mrs. Stanley had never seen, and which her son had the greatest delight in showing her. It had been decided that when the rest of the party returned to England, he should go on to Egypt, but this plan was changed by circumstances which fortunately enabled him to witness the funeral of the Duke of Wellington. By traveling day and night, he arrived in London the night before the ceremony. Almost imme-

diately afterward he returned to take leave of his mother at Avignon, before starting with his friend Theodore Walrond and two others on that long and happy tour of which the results have appeared in "*Sinai and Palestine*"—a book which, without any compromise of its own freedom of thought, has turned all the knowledge of previous travelers to most admirable account.

In 1854 the attention of the family was concentrated on the East, as Mary Stanley escorted a body of nurses to Constantinople, and took charge of the Hospital of Koulalee during the war in the Crimea, gaining much experience at this time, which was afterward useful in her self-denying labors for the poor in London.

In 1858 Arthur Stanley gave up his happy home at Canterbury for a canonry at Christ Church, Oxford, attached to the Professorship of Ecclesiastical History to which he had been appointed two years before. His three "*Introductory Lectures on the Study of Ecclesiastical History*," delivered before his residence, had attracted such audiences as have seldom been seen in the University Theater, and aroused an enthusiasm which was the greatest encouragement to him in entering upon a course of life so different from that he had left: for he saw how a set of lectures, usually wearisome, could be rendered interesting to all his hearers, how he could make the dry bones live.

Henceforward, for some years, the greater portion of Stanley's days was spent in his pleasant study on the ground floor (in the first house on the left after entering Peckwater from Tom quad); looking upon his little walled garden, with its miniature lawn and apple-trees, between which he was delighted to find that he could make a fountain; attended to by his faithful married butler and housekeeper, concerning whom, when some one remarked disparagingly upon their increasing family, he is recollected characteristically to have exclaimed, "I do not know if they will have many children, but I do know one thing, that, if they have a hundred, I shall never part with Mr. and Mrs. Waters."

Here he was always to be found standing at his desk, tossing off sheet after sheet, the whole floor covered with scraps of papers written or letters received, which, by a habit that noth-

ing could change, he generally tore up and scattered around him. Here were composed those Lectures on the Eastern and afterward on the Jewish Church, which Stanley's "picturesque sensibility," as Lord Beaconsfield called it, so exactly fitted him to do justice to—lectures which have done more than anything ever written to make the Bible history a living reality instead of a dead letter, which, while with the freedom which excited such an outcry against Dean Milman, they do not scruple to describe Abraham as a Chaldean Sheykh of the desert, Rachel as a Bedouin chief's daughter, and Joseph as the royal officers are exhibited in the Theban sculptures, open such a blaze of sunshine upon those venerable histories, that those who look upon them by the new light, feel as if they had never seen them before.

It was a great pleasure to Stanley in the years of his Oxford life to take up the threads of many old friendships which years of separation had relaxed. He also took advantage of introductions from Rugby, and of the acquaintances made in college by a young cousin residing in his house, to invite many undergraduates to his canonry, by seeing them again and again to become intimate with them, and in many cases to gain a permanent influence over them. Those he was really at home with, will always retain a delightful recollection of the home-like evenings in his pleasant drawing-room, of his sometimes reading aloud, of his fun and playfulness, and of his talking over his future lectures and getting his younger companions to help him with drawings and plans for them. The Prince of Wales, then an undergraduate, was frequently at the canonry, and Stanley had many more visitors from the outside world at Oxford than at Canterbury—Germans, Americans, and the friends he had made during a tour in Russia.

In the early spring of 1862, in fulfillment of a wish which had been expressed by the Prince Consort, Arthur Stanley was desired to accompany the Prince of Wales in his projected tour to the East. In looking forward to this journey he chiefly considered with joy how he might turn the travel to the best account for his royal companion, and how he might open

for his service the stores of information which he had laid up during his former Eastern tour. But he combined the duties of cicerone with those of chaplain, and his sermons preached before the Prince of Wales at Tiberias, Nazareth, and other holy sites of sacred history, were afterward published in a small volume. "Gather up the fragments that remain, that nothing be lost," was his constant teaching in Palestine. "It is by thinking of what has been here, by making the most of things we see in order to bring before our minds the things we do not see, that a visit to the Holy Land becomes a really religious lesson." To Stanley's delight, one great event marked the royal tour in the East: the Mosque of Hebron, hitherto inexorably closed, was thrown open to the travelers.

It had not been without many sad and anxious misgivings that Stanley had consented to obey the desire, not command, of his Queen, in being a second time separated from his mother for so long a time and by so great a distance. He never saw her again, yet he was the only one of her children who received her farewell words, and embrace, and blessings. A few days after he was gone she became ill, and on the morning of the 5th of March, in painless unconsciousness, she died. It was as well, perhaps, that the dear absent brother was not there, that he had the interest of a constant duty to rouse him. He returned in June. Terrible indeed is the recollection of the piteous glance he cast toward his mother's vacant corner, and mournfully, to those who were present, did the thought occur, *what* it would have been if she had been there then, especially then, with the thousand things there were to tell her.

Sad indeed were the months which followed, till, in the autumn of 1863, Arthur Stanley was appointed to the Deanery at Westminster, and soon afterward, sunshine again flowed in upon his life with his marriage, in Westminster Abbey, to Lady Augusta Bruce, fifth daughter of the seventh Earl of Elgin.

Of all that his marriage was to Dean Stanley, it is too soon to speak now—of the absolute completeness with which Lady Augusta filled the position of his wife, of mistress of the Deanery, of leader of every good work in Westminster. "By her

supporting love he was comforted for his mother's death, and her character, though cast in another mold, remained to him, with that of his mother, the brightest and most sacred vision of earthly experience."

Congential, as all Stanley's other homes, were the surroundings of the residence under the walls of the Abbey, decorated by much of the old oak furniture, inanimate friends, which had already traveled from Alderley to Norwich, Canterbury, and Oxford. Most delightful was the library at the Deanery, a long room surrounded by bookcases, with a great Gothic window at the end, and a curious picture of Queen Elizabeth let in above the fireplace. Here, all through the mornings, in which visitors, with very rare exceptions, were never admitted, the Dean stood at his desk and scattered his papers as of old, while Lady Augusta employed herself at her writing-table close by. The second and third volume of his "Jewish Church," his "Address on the Three Irish Churches," his "Lectures on the Church of Scotland," his "Addresses" as Lord Rector of St. Andrew's, and many articles for the Quarterly, the Edinburgh, the Nineteenth Century, Good Words, and Macmillan's Magazine, flowed from his pen in this room: and lastly his "Christian Institutions," which seem written chiefly to disabuse people of the fancy of Roman Catholic and High Church divines, that they can discover in the Early Church their own theories concerning the papacy, the hierarchy, and the administration of the sacraments. It was a necessity to Stanley to be always writing something. He often, latterly, returned to the pursuit of his earliest days, and expressed himself in verse, much of which has appeared in this magazine.

More than ever did friends gather around Stanley during his life at the Deanery, as much as ever was he able to enjoy the pleasures of society, growing every year more full of anecdote, of animation, of interesting recollections. And the visitors whom the Dean and Lady Augusta delighted to receive comprised every class of society, from their royal mistress and her children to great bands of working men, whom it was an especial pleasure to Arthur Stanley to escort over the Abbey him-

self, picking out and explaining the monuments most interesting to them. Every phase of opinion, every variety of religious belief, above all those who most widely differed from their host, were cordially welcomed in the hospitalities of the Deanery; and the circle which gathered in its drawing-rooms, especially on Sunday evenings after the service in the Abbey, was singularly characteristic and unique. At the same time the spare rooms of the house were ceaselessly filled with a succession of guests, to meet whom the most appropriate parties were always invited, or who were urged by the Dean unrestrainedly to invite their own friends, especially the now aged aunt, his mother's sister, long the survivor, as he expressed it, "of a blessed brotherhood and sisterhood."

Greater, too, than the interest of all his other homes, was that which Stanley found in the Abbey of Westminster—"the royal and national sanctuary which has for centuries enshrined the manifold glories of the kingdom"—of which he was now the natural guardian and care-taker. There are those who have smiled at the eagerness he occasionally displayed to obtain the burial of an illustrious person in the Abbey against all opposition. There are those who have been incapable of understanding his anxiety to guard and keep the Abbey as it had been delivered to him; wisely objecting even to give uniformity to a rudely patched pavement, on account of the picturesqueness and the human interest attached to its variations of color and surface; delighting in the characteristics of his choir projecting into the nave, like the coro of a Spanish cathedral;* carefully, even fiercely, repelling any attempt to show more deference to the existing monuments of one age than of another, each being a portion of history in itself, and each, when once

* It was painful to those who knew the Dean well to see a letter in *The Times* a few days after his death, urging that the destruction of the choir—the thing of all others he most deprecated—should be carried out as a memorial of him! Those who wish to know what he really desired for his Abbey have only to read the preface to his "*Memorials of Westminster*," expressing his anxious suggestion of a cloister for the reception of future monuments, inclosing the Jewel Tower, on the present site of Abingdon Street, to face the Palace of Westminster on one side, and the College Garden on the other.

placed there, having become a portion of the history of the Abbey, never to be displaced. The careful collecting and replacing of the fragments of the reredos of St. Michael's altar, the curious bringing together of tiny fragments of lost screens and altars in the Chapter House, are marks of his tender care for the minutest details of the Abbey, which it was his great object to preserve, to enrich, but never under any false pretext of "restoration" or improvement, to change. How enraptured he was to discover the monogram of Izaak Walton scratched by the angler himself upon the tomb of Isaac Casaubon; how delighted to describe the funeral of Henry V., in which his three chargers were led up to the altar as mourners behind his waxen effigy; how enchanted to make any smallest discovery with regard to those to whom the more obscure monuments are erected, to trace out the whole history of "Jane Lister, dear childe," who is buried in the cloisters, and upon whom he preached in one of his sermons to children; how pleased to answer some one who caviled at the space allotted to the monument of Mrs. Grace Gethin, with the quotations referring to her in Congreve and D'Israeli. One of his last thoughts connected with outside life was the erection of a monument to mark "the common pit" into which the remains of the family and friends of the great Protector were thrown at the Restoration.

At Westminster Stanley preached more often than he had ever done before; but two classes of his sermons there will be especially remembered—those on Innocents' Day to children, so particularly congenial to one whose character had always been so essentially that of the "pure in heart," and those on the deaths of illustrious Englishmen, often preached in the Abbey, even when those commemorated were not to repose there. "Charity, Liberality, Toleration," these became more than ever the watchwords of his teaching, of his efforts to inculcate the spirit that would treat all who follow Christ as brothers, by whatever path they might be approaching him, and by whatever hedges they might be divided. His last utterance in the Abbey, on Saturday, July 9, was on the text, "Blessed are the merciful, for they shall obtain mercy. Blessed are the pure

in heart, for they shall see God"—one of his course of sermons on the Beatitudes. In everything his precept was that of the aged St. John—"Little children, love one another."

The thought of the Abbey recalls the Jerusalem Chamber and the meetings within its walls of the Lower House of Convocation, in which the Dean so frequently spoke, often perhaps in too vehement defense of a cause or a person he thought to be unjustly oppressed, often perhaps incurring the silent censure of many a remote country parsonage by the expression of his opinions, but ever with kindly feelings towards those from whom he differed the most, and who, when they knew him well, seldom failed to love and appreciate him. Through life the exemplification of Christian catholicity in his own person, Stanley could hardly help taking part with those who were attacked, whenever he saw that religious animosity was excited. "Charity suffereth long and is kind" was never absent from his thoughts, and led him to be ever the champion of the persecuted, of Tractarians in early life, as afterwards of the writers in *Essays and Reviews*, and of Bishop Colenso.

Next to the immediate concerns of his Abbey, was Stanley occupied by the welfare of the poor around him, whom he tried without ceasing to raise, cheer, and enliven, sending many a mental sunbeam into a dismal home by the thought of his annual flower show and its prizes, and taking great personal interest in the neighboring hospital and its work. In all his efforts for the people of Westminster, the Dean was ably seconded by Lady Augusta. His desire to benefit the working classes was also shared by his elder sister Mary, who, in a direction quite independent of his own, was unceasingly employed in trying to find employment for the poor, to teach them provident habits, and to improve their homes. At one time she undertook the anxiety of a large contract to supply the army with shirts in order to give employment to a great number of poor women. Latterly her wonderful powers of organization always enabled her to deal with vast numbers, but it had taken long years of personal work amongst the people to acquire her experience, as well as the respect and confidence which contributed so

much to the success of her schemes for their good. Of all these, the most important was the penny bank, opened once a week in a little court at the back of a house in York Street, Westminster, and managed personally by Miss Stanley for more than twenty-five years; having as many as 1000 depositors at a time. The undertaking was indescribably laborious, especially during the annual audit week in December, when every single account had to be compared with that in the ledger. In itself, this ledger was a study—the dates for the whole half year on one page (to save turning over), the blotting paper stitched in between each leaf (to save blotting), for in dealing with such large numbers every instant of time saved was of importance. No less remarkable was the simple but ingenious device by which the visits of her numerous clients were distributed equally over the three hours that she sat at the receipt of custom, so that each should be speedily served, and that there should be no undue crowding at one time. Mary Stanley would invite four or five ladies, before the people arrived, to come and tie up flowers for them in bunches. Many hundreds of nosegays were thus prepared, and it is remembered how anxious she was that they should be *prettily* arranged, for “I want to give my people what is beautiful, and what is worth doing at all is worth doing *well*.” Her invariable patience, quickness, and good-humor with the people rendered what would have been impossible to many, comparatively easy to Mary Stanley; but a brave heart was also required, and a friend who thought of starting a similar bank in another part of London, and came to her with all its dangers and difficulties, recalls the energy with which she closed the discussion: “My dear, if you stand counting the difficulties when there is a good work before you, you will never do anything that is worth doing all your life! Only begin, begin, begin, and the difficulties will all disappear.” Under other superintendence and in another house the penny bank founded by Mary Stanley still flourishes in Westminster, a memorial of her energy, kindness, and wisdom.

Dean Stanley's marriage with the devoted attendant of the Duchess of Kent, whom the Queen honored with unvaried

kindness and friendship, had brought him into constant communication with the Court, to which the outward tie had been drawn closer by his appointment of Deputy Clerk of the Closet, Chaplain to the Queen, and Chaplain to the Prince of Wales. He was summoned every year to take part in the services which commemorate at Frogmore the death of the beloved Prince Consort. It was after representing her royal mistress at the marriage of the Duke of Edinburgh in the bitter Russian cold of January, 1874, that Lady Augusta Stanley received the chill from which she never recovered. A long interval of hopes and fears, another year of sad forebodings and farewells, and, on Ash Wednesday, 1876, one of the happiest of earthly unions was severed by her death at Westminster.

The sunshine of the heart was dead,
The glory of the home was fled,
The smile that made the dark world bright,
The love that made all duty light.

For five years Arthur Stanley was left to fulfill his appointed task alone. After a time he was full of interest still, his mental activity was as great as ever, and he was always full of work. Sometimes when he was in the society of those whose thoughts met his, some of his old animation and cheerfulness returned; for a few months the kindly welcome and friendship shown to him during a visit to the United States almost seemed to make him happy; and he ever gratefully recognized and reciprocated the loving attention with which his home was cared for by his wife's sister and her cousin, who had been more than a sister. But his friends saw him change more and more every year—his hair became gray, his figure became bent, his voice became feeble; and after the death of his dear sister Mary, in the spring of 1880, had loosened another of his closest ties to earth, he seemed to be only waiting for a summons which could not be very far off. In speaking of what he would do in the future, he now always said, "If I am still here," and he looked at places as if for the last time.

On Good Friday he preached upon the words, "Father, into thy hands I commend my spirit." He said he had preached

the same sermon in the same pulpit at that season ten years before, and he would like to preach it once again. The way in which he said "once again" sent a thrill of sadness through all who heard it.

On Saturday, July 9, during one of his sermons on the Beatitudes, he was taken ill in the Abbey, and though there were few who believed him in danger till within some hours of the end, all through the week which followed he was being led gently and painlessly to the entrance of the dark valley, and, on July 18, just before the Abbey clock struck the hour of midnight, surrounded by almost all those he most loved on earth, his spirit passed away.

In speaking of his dear Westminster, the sense of his last words was, "I have labored amid many frailties and with much weakness to make this institution more and more the great center of religious and national life in a truly liberal spirit."

This was the characteristic of his existence; thus, in most loving reverence, should he be remembered.

AUGUSTUS J. C. HARE, in *Macmillan's Magazine*.

THE CANADIAN TARIFF.

England is angry with Canada about the new Canadian tariff; and angry she would have a right to be if the tariff were, as she seems to suppose, protectionist and directed against the mother country.

Directed against the mother country with any unkind intention it is impossible that the Canadian tariff, or any other measure adopted by Canada, should be. The feeling of British Canadians toward England is as warm as any reasonable Englishman can desire. The French are French, and their hearts turn to their own mother country. The Irish are Irish, though less Fenian than their compatriots in the United States, as their conduct with regard to the Land League has shown. But the

British of all parties retain their affection for England. The relaxation of the political tie has only strengthened the natural bond.

Nor is the Canadian tariff protectionist, except in relation to the coal tax, which is imposed avowedly for the purpose of compelling western Canada to burn Nova Scotia coal, but does not concern England. It is not protectionist, at least in its main object or in its direct intention, though it may be said to have a protectionist or quasi-protectionist aspect to which reference shall presently be made. It is the offspring of sheer fiscal necessity. There was a large and growing deficit, which it was imperative to fill. There were only three ways of filling it—further borrowing, direct taxation, and an increase of the import duties. Further borrowing would have been profligate; it would of course have impaired our credit, and would only have staved off the need; the English creditors of Canada, at all events, would not have desired that we should take this course. From direct taxation all statesmen in communities like Canada shrink on political and social as well as on financial grounds. An increase of the import duties alone remained. The effect has been an addition to the revenue, which has not only filled the deficit, but produced a surplus, though of what amount it would not be safe to say before next winter, when the finance minister will make his statement. The character of the tariff as a revenue tariff is thus vindicated by the result. The writer of this paper has been assured by leading commercial men in Canada, who are in principle free-traders, and who are unconnected with politics, that the measure on the whole was as well framed as the circumstances would permit; and the opposition, while as a matter of course it has denounced the government plan, has as yet propounded no counter-plan of its own. The object, announced from the Throne, was not the protection of native industry, but the equalization of revenue with expenditure, and the framers are men who have always professed free-trade sentiments, besides being the heads of the Conservative and imperialist party.

The tariff is directed, if against anybody, against the people of the United States, who were excluding Canada from their

markets, and at the same time throwing their surplus goods, whenever there was a glut, at very low prices into the markets of Canada, not perhaps in large quantities, but in such a way as to derange the calculations of Canadian manufactures, and prevent, so it was alleged, the free growth of Canadian enterprise. There is a rider to the tariff providing that if the United States will lower their duties, Canada will lower hers. Sir John Macdonald and his colleagues are, in fact, able to boast that the result of their policy has been a diminished importation of American and an increased importation of British goods, though it would be unsafe to join in their exultation without knowing the statistics of smuggling, which, on that long and perfectly open frontier, always goes on to a large extent, and has no doubt increased since the raising of the duties on American goods, being, in fact, the irregular protest of nature against an artificial line.

The Canadian tariff, we repeat, is the offspring of sheer fiscal necessity. And how was the fiscal necessity produced? How comes it to pass that, though Canada has had no civil war and her defense is mainly undertaken by England, her financial condition is now actually worse than that of the United States; that her public debt is heavier in proportion to her population, and much heavier in proportion to her wealth, than theirs; that while their debt is being rapidly reduced, hers is still increasing; and that her most experienced financier, Sir Francis Hincks, finds it his duty to warn her, in the *Montreal Journal of Commerce*, that her liabilities are being piled up at a most dangerous rate, and that the reckoning day is at hand? The answer will show that imperialism, though it may be a magnificent policy, is a policy for which you pay, and that for the increased duties laid by her North American colonists on her goods England has mainly herself to thank.

Of the public debt of Canada, half, at least, may be set down to the account of public works, undertaken not so much for the commercial objects of the colony as for the political objects of the empire, and especially to the account of a vast system of political and military railways, destined to carry into effect a policy of British antagonism to the United States.

On the political map the Dominion of Canada, since the annexation of British Columbia, appears a solid mass of territory, broken only by Alaska, and nearly equaling in extent the territory of the United States. Such is the picture which imperialist rhetoric always presents, while imperialist ambition sees in the vast expanse the destined seat of an empire which shall balance the dreaded power of the republic, and wrest from democracy a noble cantling of the New World. But take the physical map, and it will appear that instead of being a solid mass the Dominion is made up of four separate blocks of territory, lying along the skirt of the region of ice and snow, destitute of any but political unity, and separated from each other by formidable, if not insurmountable, barriers of nature. The four are : the maritime provinces, Nova Scotia, New Brunswick, and Prince Edward's Island ; Canada, French and British, now the provinces of Quebec and Ontario ; Manitoba, with the rest of the provinces to be formed out of the prairie region of the north-west ; and British Columbia. The peopled parts of the maritime provinces are cut off from Old Canada by the State of Maine, and by the wastes through which, hardly taking up a passenger or a bale of freight, the Intercolonial Railway runs. Old Canada is cut off from the prairie region of the north-west by the great inland sea called Lake Superior, the southern shore of which belongs to the United States, the northern shore to winter and desolation, while navigation is closed during more than half the year. The prairie region is cut off from British Columbia by a series of mountain ranges presenting formidable difficulties to the engineer, and, as has been stated, to the working of railways when constructed. The natural connection of the maritime provinces is with Maine and the other Eastern States ; the natural connection of Old Canada is with the Northern States and with Pennsylvania, from which it draws its coal ; the natural connection of the prairie region is with Minnesota and the other States of the West, from which it is divided by nothing but a political line ; the natural connection of British Columbia is with California. The natural route from the maritime provinces to Old Canada is through Maine ;

the natural route from Old Canada to the prairie region is by the south shore of Lake Superior, starting from the Sault Ste. Marie; the natural access to British Columbia is from California. The want of commercial unity between the four territories is not less marked than their want of geographical unity, of which it is the consequence. To reconcile the maritime provinces to a Canadian tariff it has been found necessary, as we have seen, to give them a protective duty on their coal; and the opposition, while it denounces the government policy as protectionist, has been restrained by its fear of losing the votes of the maritime provinces from saying a word against that which is in reality the only protectionist tax of the whole.

Now imperialism has undertaken, in defiance of nature and of all those economical considerations by which free-traders say that the world ought to be governed, to weld these four separate territories into a united empire, and to cut them off forever commercially as well as politically from the rest of the continent by a line of political and military railroads carried from ocean to ocean entirely within the territory of the Dominion. The eastern wing of this line is the Intercolonial Railway, intended to knit the maritime provinces to Old Canada. The construction of this road is enjoined upon the Dominion by the imperial Act of Confederation, and was promoted by an imperial guarantee. It has cost about thirty millions of dollars. It has been worked hitherto by government at an annual loss. Herculean efforts are just now being made to exhibit it as self-supporting; that it will ever pay interest on the outlay is what nobody pretends to believe; but an experienced railway president, a man certainly not unfavorable to the policy of which the road is an embodiment, told the writer of this paper that the average annual loss in his opinion was not likely to fall short of half a million, which if capitalized would bring the total outlay up to forty millions. The direct route through Maine is likely soon to be opened, and when it is opened it is difficult to see how the Intercolonial Railway is to continue to be worked at all. The most enthusiastic imperialist can hardly be sanguine enough to believe that passengers will travel, and shippers send their goods, two hundred

miles round for the patriotic purpose of maintaining a military and political road.

As a military road the Intercolonial is pronounced by military men a failure. The portion of it running near the frontier of Maine would, as soon as war broke out, fall into the hands of the enemy. Nor does its success as a bond of political union between the provinces appear much greater. The Nova Scotia correspondent of *The Toronto Globe*, a strongly imperialist journal, said not long ago :—

He would be an unfaithful chronicler of current events who, writing from Nova Scotia at present, should ignore the fact that there is a very large element of dissatisfaction, which rises above the conflict of political parties, and strikes at the constitution itself. In city and country, from all parts of the province, one hears of a sentiment which is expressed in the significant word *Repeal*. At no time during the past decade was that ominous word on so many lips as now. It cannot be said that this is the result of agitation, for there has been no agitation. There is no repeal movement. There are no repeal leaders. And yet repeal—secession would be a more correct term, perhaps, but I use the word I hear—is talked of in all quarters as a most desirable thing.

The writer goes on to show that the disaffection is caused not by the new tariff or by any particular grievance, but by general dissatisfaction with the results of confederation. A Conservative journal in Ontario was complaining the other day that a large party—the party now supposed to be the majority—in the maritime provinces thought and spoke of Canada as a foreign country. The representatives of Nova Scotia, New Brunswick, and Prince Edward's Island, in fact, go to Ottawa mainly to attend to their provincial interests; they can hardly be said to have blended with the old Canadian parties; they form three flying squadrons for the support of which the old Canadian parties bid against each other.

The western wing of the imperialist line is the Canadian Pacific, in the construction of which, by the hands of a company, the Dominion is now engaged, and which, like the Intercolonial, has received a British guarantee. It consists of three sections: that along the north shore of Lake Superior; that through the prairie region; and that running from the prairie region through the mountain ranges which divide that region from British Co-

lumbia and through British Columbia itself to the Pacific. The section to the north of Lake Superior is said to present tremendous engineering difficulties, the route being scored with the wide and deep beds of primeval rivers; and we are told that in this, as in the mountain section, the climate is likely to interfere with the working of the road in winter. Eminent commercial men in Canada hold that the construction and working of this section for about 700 miles will be a dead loss. It is difficult to believe that the mountain section will be profitable, since British Columbia, when it is reached, has a population of twenty thousand whites and about forty thousand Indians. That any port in British Columbia will wrest the Pacific trade from San Francisco can seem probable only when we see it done.

Railways opening up the prairie region will of course pay, and pay well, if that region is in fertility and general fitness for settlement anything like what we suppose. But a single road will only open up a belt of fifty miles, half that distance being as far as a farmer can draw grain in a day. Moreover, this single road is laid out not in accordance with the behests of commerce, but in compliance with the requirements of the political line. The consequence is that the company into whose hands the construction and working of the line have now been happily transferred from those of government is obliged to demand that a restriction shall be laid on the construction of commercial lines which would carry off the traffic from the government line, though the restriction can hardly fail to be injurious to the commercial development of the province, and is not unlikely to be the source of future discontent and strife.

The region to the north of Lake Superior is no doubt rich in wood, the conveyance of which may for a time furnish traffic for the road, especially as in the prairie region there is a lack of fuel. But when the country is cleared the timber trade ends, and the district is deserted unless the land can be brought under the plow. Even while the timber trade lasts, it will not much promote the political object of the railway. The prairie region will still be severed from Old Canada by a vast wilderness, peopled only by a few lumbering parties, and as estranging as any sea.

Under the agreement ratified in the last session of the Canadian Parliament, Canada gives the company formed for the construction of the road twenty-five millions of dollars in cash, thirty-one millions in completed works (including surveys), and twenty-five millions of acres of land, besides exempting its materials from import duties, and its lands and works from taxes. These were the best terms that could be made for us by negotiators so able as Sir John Macdonald and Sir Charles Tupper, the latter of whom was charged with having received a bribe, but without a shadow of evidence and against all the probabilities, the organizers of the company being, fortunately for the country, men of the highest character, whom no one but a violent partisan could suspect of resorting to corruption. The country acquiesced with a groan, feeling that the price was enormous, feeling also that there was great danger in creating such a power as this huge railway and land-owning company in the north-west, but being willing at almost any cost and risk to be saved from the gulf of public corruption which yawned before it while the work and all the contracts connected with it were in the hands of government. In a community such as Canada, the waste of money on useless public works is not a greater evil than their tendency to beget corruption. An experienced politician is reputed to have said that the Intercolonial Railway ought to keep any government in power for ten years. The present undertaking began with the Pacific Railway scandal, and the results of an inquiry now in progress have already shown that it has gone on as it began.

Nor, large as is the price now paid, is it likely that the Dominion will be quit of liability for the future. Manitoba and the other provinces to be carved out of the north-west will hardly have an acre of land which they can call their own. They are precluded from taxing land in the hands either of the government or of the company. They will therefore have to come upon the Dominion for the expenses of their administration; and if their votes chance ever to be greatly in request, they will probably come upon it with a vengeance.

The character of the Pacific Railway as a political line is

stamped by the fact that its construction is undertaken in fulfillment of a treaty with British Columbia, made for the purpose of incorporating that province with the Dominion, not perhaps without an eye to the acquisition, by the party in power, of the British Columbian vote. Like the Intercolonial, it has received an imperial guarantee. Its efficiency as a bond of political union remains yet to be proved. Hitherto British Columbia has really done nothing but extort money by threats of secession from the confederation. The idea which appears to be entertained at the Colonial Office, that confederations can be made at will where they are not suggested by any necessity such as that of mutual defense against an assailant and ratified by nature, is not borne out by experience. Artificial union seems to develop latent antagonisms in proportion to the strictness of the bond. Even the eastern provinces have been held in the confederation to a rather ominous extent by pecuniary concessions, styled "better terms."

The lands of the north-west, which, in virtue of a grant from England, the Ottawa government has, with indisputable legality, been treating as absolutely its own and using to defray the cost of a policy of imperial aggrandizement, were morally the heritage of communities unborn, and their price, if they were to be sold, ought to have been applied in the first instance to the development of the country in which those communities were to dwell. The communities are now born; they will grow; they will become powerful; and in time they will bethink them of their misappropriated heritage. This is a probability of the future, and of the not very distant future, which calls for serious consideration on the part of all whom it may concern. Canadian statesmen, even the best of them, are forced by the exigencies of the party system to live pretty much from hand to mouth, and if the questions of the future are pressed upon them to say, "After me the deluge." Commerce, therefore, if she is interested in the future, will have to exercise forecast for herself.

An opponent of imperialism is not likely to take a sanguine view of the prospects of an imperialist enterprise. But nothing

can look less promising than an attempt to put eternal severance, commercial and social, as well as political, between the people of English-speaking race in Canada and those on the other side of the line. The two countries are completely interlocked; the four masses of territory belonging to the Canadians being in fact projections, varying greatly in size, of the habitable and cultivable continent mainly occupied by the Americans into the realm of snow. The Western States cannot do without the St. Lawrence; Canada is indebted to the United States for winter ports, and for the transmission of her goods in bond, by stopping which the Americans would be able, at any time, to put on her a very serious pressure. The people are identical in race, language, character, religion, and fundamental institutions. Canadians go to settle in the States by tens of thousands; they go with as little hesitation or compunction as a Yorkshireman has in going to settle in London. The Canadian farmer who, in answer to a leading question put by an English visitor, vows that he is devoted to monarchy and could not live in a republic is off next day to Minnesota or Dakota. The journalist who pens the ultra-loyal invectives against annexation which you read with delight to-day will to-morrow be on the press of New York. A military college is founded at great expense for the purpose of training officers to command the armies of Canada against the Americans; about the first cadet who passes sets up as an engineer at Chicago. Americans are getting the railways and other commercial enterprises of Canada more and more into their hands. One of our two great telegraph lines is leased to an American, and an appeal made to the meeting against the proposal on patriotic grounds fell perfectly dead. The very company to which the construction of the Pacific Railway has been consigned is in part American, and has its head-quarters at St. Paul, in Minnesota. The natural routes between the provinces of the Dominion are, as has been already said, through the territory of the United States. Access to the markets of the United States for the lumber which is her staple and for other products is to Canada a vital necessity, and no trade either with England or with any other distant countries can

possibly make up to her for its loss. Nature has in every way put her ban upon this enterprise, and though expense ruinous to Canada may be incurred, and her commercial interests may be sacrificed in the attempt, the ban will not be removed.

To the expenditure on Canadian public works in general a percentage may be said to have been added by deflection from the line of commercial advantage in the interests of imperial policy. Of this the Rideau Canal is an example.

Another source of waste and consequent deficit is the needlessly complicated and expensive character of the form of government given to Canada by the Act of Confederation. For less than four millions and a half of people we have eight petty monarchies, one central and seven local, with their respective cabinets, and eight legislatures, all the members of which are paid. Unfortunately, the loss of money is not the worst part of this system; the worst parts are the creation of a numerous class of office-seeking politicians, and the propagation of a fatal tendency to desert honest labor and seek to live upon the public. The Dominion is fast becoming in this respect an exaggerated counterpart of the United States.

That Canada has an organized force of four hundred thousand men, and that its whole population has on several occasions sprung to arms, in a state of perfect readiness to take the field, are preposterous fables, and it is to be hoped that the Commission of Inquiry into Colonial Defenses will put an end to therodomontading on this subject. That Canadians have high military qualities has been more than once proved; but they would show little sense if, instead of earning their livelihood, as Nature calls them under somewhat stern conditions to do, they were to spend their time in amateur soldiering. Yet a good deal of money has been and is still being wasted on military preparations against a foe who will never come, and whom, if he did come, with his immense superiority of numbers and resources, it would be impossible to resist. In the mean time indispensable services are starved. The special wealth of Canada are her forests, and these are being devastated year after year by fires, kindled by recklessness and sometimes by malice, for want of a

proper forest guard. The police, too, is inadequate: the other day we had a sanguinary case of lynching in the heart of Ontario, and the provincial government has been trying in vain to bring people to justice for a violent and ruthless act of self-redress, which was the consequence of its own inability to enforce law.

Let us have sentiment by all means, as well as that material well-being for which alone Manchester is supposed to care, though in fact she has just been founding a university, and is as generous in promoting high objects of every kind as any city in the world. But of all sentiment the most unquestionably good is that which gathers round a happy home, and of this material welfare is the indispensable condition, talk as grandly about empire as you will. In Hare's "Memorials of a Quiet Life" there is a story of a farm-laborer who, having been allowed to spend a few days beside his mother's death-bed without having his wages stopped, was so overpowered by such unwonted and un hoped-for kindness that he could never speak of it without tears. This peasant was one of the lords of an empire on which the sun never sets. It is well to remember that the empire about which those proud words were first uttered was that of Spain, on which the sun has set to rise no more.

Imperialist policy is all the time cutting its own throat. By running Canada into debt it has forced her to lay heavy duties on English goods, and thus to break the commercial unity and contravene the commercial policy of the empire. By the same process it has repelled from the confederation Newfoundland, who, not wanting to put her back under the burden, decisively refuses to come in. It has also helped to frustrate its own plans in South Africa, where the people, being bidden to look at the results of confederation in Canada, did look, as the debate in the Cape Parliament showed; saw what the results in the financial department were; and, instead of following the example proposed to them, profited by the warning. Nay, the very annexation of the north-west, which was to give the anti-American empire substance and a backbone, is not unlikely to

prove the instrument of dissolution. The north-west will not be peopled in the main by British farmers, who, though excellent agriculturists, are indifferent pioneers, and if they wish to emigrate, would do better on the farms of Old Canada, especially on those of Ontario, many of which are being left vacant by Canadian farmers moving to the new territory or to the States. It will not be peopled by Irish peasants, who are hardly farmers at all, and who, set down in a solitude, and in a climate which must be intolerably severe for those who are not well clothed and housed, would soon be compelled to move south. It will be peopled, like the Western States of the Union, chiefly by the onward march of population on the continent itself. A large proportion of the settlers will probably be Americans; and in that remote region, with its new and motley population, the loyalist traditions of Old Canada and her memories of the war of 1812, already faint in their original seat, will hardly find a place. The great provinces of the north-west will become the dominant power in the confederation; and everything will draw them toward a union with the United States.

The tariff, though not in the proper sense protectionist, has a quasi-protectionist aspect; this has been already admitted. Taxes imposed on foreign goods afford incidental protection to goods of the same kind made at home. At the preceding election the country had been swept by the cry of "national policy;" that is to say, a fiscal system adjusted to the special interests of Canadian manufactures, in which the people were led to believe they would find a cure for the commercial depression then prevailing; and the change has been followed by a rush, probably too great a rush, of capital into enterprises of that kind.

It may be at once granted that to Canada a protectionist system would be ruinous. She is not like the United States, a self-sufficing continent, but a country with a range of production narrowly limited by climate, and with small markets, whereas now, manufactures having become highly specialized, large markets are indispensable to success. Nor can the general principle of free trade, either in regard to production or distribution

appear otherwise than evidently true, from whatever point on the earth it may be viewed. Still the circumstances of England are special; the theories of her economists can hardly escape being to some extent colored by her circumstances; and even a member of the Cobden Club, when transferred to another country, sees matters in a somewhat different light. He is able, at all events, to comprehend protectionist arguments which were incomprehensible to him before. England, while she preaches free trade to all the world, is not herself a free-trade nation. She raises twenty millions a year by customs duties, which are to the full extent of their incidence interferences with freedom of trade, and, if not protective, discriminative in favor of the goods which are not taxed. The repeal of the corn laws, though a most wise and beneficent measure, was not free trade. It was merely the abolition of a particular duty, the retention of which would have been injurious to England as a manufacturing country needing large supplies of imported food. Nor were the members of the league as a body cosmopolitan philanthropists crusading against import duties in the general interest of mankind. Some of them were, and still are; but as a body they were simply English manufacturers agitating for an object of special importance to themselves. Cobden was a genuine free-trader; he would have abolished all import duties and substituted direct taxation. But the men who commonly assume the name are simply Englishmen who have judiciously regulated their own tariff in the true interest of their own industries.

If all the world were one community, free trade would be its law. No protectionist is insane enough to propose to run a customs line across the territory of a united nation. And that all the world is one community the enthusiastic apostles of free trade seem often unconsciously to assume. Unfortunately the realization of that assumption, though all good men are working toward it, belongs to a remote future. At present the world is divided into separate nations, rivals and possible enemies of each other. Each nation requires not only its own establishments, but, unhappily, its own armaments; to maintain them each is obliged to impose import duties, experience having

proved the moral evil as well as the intolerable irksomeness of direct taxation on a large scale; and in framing its tariff each will, as far as it can, give an advantage to its own industries over the industries of its rivals. This they will all persist in doing, preach to them as you may. Their conduct, viewed in relation to the largest interests of humanity, may not be rational; neither is aggrandizement nor war. Europe turning a deaf ear to the free-trade counsels of England has been compared by free-trade writers to a mad patient rejecting the advice of a wise physician. It is not the wisdom but the disinterestedness of the physician as to which Europe has misgivings. With regard to the motives of Cobden, Bright, Thomas Bayley Potter, Sir Louis Mallet, Mill, there can be no room for doubt; but is there no room for doubt as to the motives of Lancashire when with one of her voices she cooes free trade, and with the other shouts British aggrandizement? The benighted foreigner may be excused for his persistence in heresy when in the same columns he reads, as it is the literal fact that he may, articles on the universal blessings of free trade, and projects for making England mistress of all the water-ways of the world. Perhaps economists bred in great centers of trade have also formed an exaggerated estimate of the efficacy of commercial motives in controlling the general passions of mankind. Free-trade propaganda has failed, and the moral of its failure seems to be that the path lies not through free trade to peace and righteousness, but through peace and righteousness to free trade. There are some to whom that conclusion is not unwelcome.

In adjusting as well as she can to her own circumstances and the interests of her own industries taxes which fiscal necessity compelled her to impose, Canada has done no more than all other nations do. The assertion of commercial autonomy on the part of a dependency is the only peculiar feature in her case. But even if she had gone further, she would hardly have been open to rebuke from a nation which is itself stimulating her, in defiance of all economical considerations, to construct political railroads and to immolate her interest on the altar of an imperial policy which cuts her off from the commercial advantages

and the circulating wealth of the continent of which she is a part. Free trade is only a special application of the general principle of non-interference with the beneficent course of nature; and if ever there was a breach of that principle, the policy which England has pursued, and is pursuing, on the North American continent is one.

The loss of reciprocity with the United States was a consequence of the political connection with England, who had exasperated the Americans by the conduct of her aristocracy at the time of the civil war. The American tariff itself, in its hostility to Great Britain, bears in no small degree the traces of the same resentment, which was, as it was just that it should be, a powerful engine in protectionist hands. That the framers of the Canadian tariff will succeed in their attempt to coerce the Americans into a renewal of the treaty is hardly to be expected. The republic is too wealthy and too proud to yield to so slight a pressure; her statesmen know too well that Canadians come over to her in crowds. But if the pressure were likely to be effectual, why should it not be applied? An immediate sacrifice would no doubt be made in refusing to buy cheap American goods; but it would be made in anticipation of a greater gain; and a doctrine of free trade which should forbid such an exercise of foresight would surely be free trade gone mad. Political economy is a matter of expediency: it is not like morality, which forbids us to do evil that good may come. If by abstaining from French wines and silks for a time England could bring France to reason, why should she not abstain? It may be that in a colony we learn rougher modes of doing things. It may be also that we learn from the exigencies of a young country the habit of sacrificing the present to the future. The inhabitants of every great city in the New World are paying the taxes of posterity, for whose benefit everything has been constructed in a day.

The motives of the Canadians in framing their new tariff were purely financial and commercial. It is not necessary, therefore, to inquire whether they would have been warranted in taking account of social objects such as the creation of a variety of

industries with a view to balancing the character and enriching the civilization of a young country. Political economists abstract the desire of wealth from all other human motives in order to form a hypothetical science; then some of them forget that the abstraction has taken place, and reason as if there were no human motive entitled to consideration but the desire of wealth. Adam Smith, unlike some of his illustrious successors, proceeded by the historical and rational, not by the dogmatic method. He sees that the navigation laws are bad for commerce, yet he upholds them on the ground that national defense is of much more consequence than wealth. On the same ground he would have let in other considerations which strict economists put out of court, because they are not commercial. There were some who, while they heartily recognized the advantages of Cobden's French treaty, as well as the high motives of the negotiator, thought the commercial benefit rather dearly purchased at the price of complicity with a stretch of power on the part of a military usurper, whom they knew at the same time to be an incorrigible disturber of the peace of the world.

A practical bearing is given to anything said at present on a Canadian question by the general expectation of a new appointment to the governor-generalship. In his official capacity the governor-general is a constitutional king, bound to do simply what his ministers tell him; though the ambiguities of the colonial constitution, which is a cross between the national and the federal, half written and half unwritten, sometimes call him, and the Colonial Office behind him, into momentary action. But personally he is enabled by his rank to exercise a good deal of influence over colonial politicians, especially as he has the bestowal of the imperial titles, which some of them deem the highest prizes. He can deliver as many orations as he pleases, under the form of making official tours, and his utterances, though they may be merely his own, are taken for utterances of the imperial government. He is also likely to have his friends in the press, both colonial and British; and wonderful symphonies they have sometimes given forth. He can do, in short, practically a good deal more than can be done by a con-

stitutional king. He comes to the country ignorant; during his stay he is protected from the approach of truth almost as effectually as any king, and when his term of five years is over his responsibility vanishes with the smoke of the parting salute.

Some years ago there might be read upon the walls in England a proclamation put forth by the Privy Council on the subject of the Colorado beetle, in the opening sentence of which Ontario was designated "that town." This was scarcely a stranger mistake than that committed by the Liberals who received with an ovation the late governor-general of Canada. Had the other party acknowledged by a banquet the zeal and address, the consummate social grace, the almost Sheridanic genius for oratory, especially for the oratory of compliment, displayed by Lord Dufferin in the service of its cause, the tribute would have been eminently well deserved. It was the boast of his lordship's admirers that he had reversed the ignoble policy of Mr. Gladstone and the Liberals. His administration was, in fact, a brilliant portion of the general reign of Jingoism, and if it was not given him to achieve an Isandula or a Candahar, peace hath her victories no less renowned than war. Canada owes to him certainly an exaltation of the governor-generalship into a viceroyalty, with a considerable increase of expenditure, as well as an accession of royal state; probably her final plunge into this policy of constructing a great anti-continental system of military and political railways, with all the consequences which it is likely to entail. The Liberal minister of the day stood wavering on the brink, and he was reputed to be much under the influence of the governor-general.

Lord Dufferin's achievements, blazoned as they had been, naturally encouraged a Jingo government to essay the complete redemption of British North America from democracy by the introduction of a regular court with etiquette. Of the present governor-general there is nothing to be said but good: he has used his personal influence for the promotion of objects which must be useful to the country whatever may be its political destiny, and in the one constitutional case in which he has been called upon to exercise his discretion he, in the opinion of all

impartial men, did right. Nothing disparaging to him personally therefore is implied in saying that the failure of the attempt with which it was his destiny to be associated was immediate and decisive. The colonists by whom the Colonial Office is advised are, naturally, the members of what the correspondents of Tory papers call "loyal circles;" they are socially, as well as politically, English, usually passing a good deal of their time on this side of the water, and being imbued with aristocratic sentiments. But the people generally, whatever they may be in political sentiment, are in social sentiment American. They received with astonishment and derision proclamations forbidding any but aristocratic equipages to appear in viceregal processions, and enjoining ladies to go to drawing-rooms in low dresses, which by some are deemed hardly moral, unless they could produce a certificate of inability on the ground of health from a physician. One of the caricatures represented an Irish girl with her bare legs presenting herself to the master of the ceremonies, and pleading that nakedness below would do just as well as nakedness above. Nor was a more loyal reception given to the "Manual of Court Etiquette," published by Mr. Fanning, after consulting the official oracles in London, for the guidance of colonists in these august mysteries, the opening paragraphs of which we will take the liberty of transcribing to show our readers what royalty in a colony would be, and what sort of character England is trying, through her representatives, to impress on a young and naturally noble nation. The section is headed "The Special Etiquette of the Bow, the Train, and the Glove."

THE FIRST PRESENTATION

is generally the formal début of a fashionable life. The members of the nobility and gentry always manage to get their daughters presented, and it is regarded as a patent of social rank by the latter. What on this earthly sphere is more enchantingly exclusive than her Majesty's court? The impression made by the débutante is a lasting one in England, and consequently art is brought to bear; and the courtesies, the walk, the extending of the arm for the train, and each physical movement are practiced repeatedly before some competent teacher of deportment who charges well for the lessons. But money is no object to the aristocracy of England when it comes to presentation lessons. The

DÉBUTANTE MUST BE PERFECT

in every movement. These teachers are all patronized by the nobility who desire their daughters respectively to be the "belle of the London season." A false step, a mismanagement of the train, a little nervousness, or *mauvaise honte*, and the whole affair is a failure.

I am informed that several Canadian ladies have been made the honored recipients of a command to appear at court, and friends to whom they have described the affair have undertaken, with misplaced courtesy, to teach *la belle Canadienne* the details of court presentation. But pretenders like these cannot confer any real knowledge of the subject. Before the young lady has made any progress in her Majesty's throne-room she feels her failure, and her disappointment is made manifest by her ungraceful courtesies; she moves too quickly, she forgets to extend her arm for her train; she backs accidentally against the diplomatic corps of the household; she passes into the green drawing-room, into the vestibule, and down the grand staircase, too quickly, not noticing the elegant statues, life-size, of the queen and late prince—the queen as a gleaner and the prince as a gladiator—both in the finest Parian marble; and she passes through the grand entrance and into her carriage

WEEPING WITH VEXATION

and disappointment. Another Canadian lady enters, glides in with a smile; her every motion grace; her step one of confidence; her name is announced to the queen by General the Marquis of Hertford, Lord Chamberlain—she makes the proper courtesy to each of the royal family, and at the end she extends her arm slowly and gracefully for her train. Then she backs out from the presence of royalty "the admired" of the beholders, who are sharp critics of style and bearing. The papers teem with her beauty and grace (you know 'tis the style now in England to admire our ladies). The teacher who gave her instructions is thanked by her chaperons on the manner in which *la belle* passed through this trying fashionable ordeal. Her standing is now fully established. She enters the carriage and drives away as happy as the birds.

THERE ARE BUT TWO TEACHERS

of court presentation that I can confidently recommend to Canadians: one is Miss Birch, 111, Gloucester Place, Portman Square, West, and Mr. L. d'Egville, No. 44, Conduit Street, off Regent Street, Hanover Square, West. Miss Birch is assisted by several assistants who stand in the relative positions of her Majesty and the royal family, and Mr. L. d'Egville is assisted by his elegant and graceful daughter and family. Both of these teachers furnish a court train for practical illustrations, and they stand the highest in the profession of deportment and dancing.

Now let me advise any ladies of Canada who may ever desire to be presented to the queen not to accept the officious courtesy of an English lady whose second cousin was presented. Go to one of these teachers, and you may then learn to walk and courtesy properly, and to approach her Majesty with dignity, modesty, and grace.

In another passage the momentous question whether, at a court reception, the presentee should be gloved or ungloved is

discussed in a catechetical form, and it is decided that the right hand should be ungloved.

Any one can see at a glance, therefore, that to visit the governor-general and his royal wife the right-hand glove must be removed. When Lord Dufferin opened Parliament, it being a representative reception, all of the guests should have appeared with the right-hand glove off, but it has never been done except by a very few who were posted in regard to visiting the queen's representative.

Therefore, those ladies who may have a desire to visit H.R.H. at the viceregal residence may depend on the following :—

On entering the building hand your cards to the servant; if you are married have "Mr. and Mrs. —" nicely engraved on one card, and "Mrs. —" also engraved on the other. Send them both in; while the servant is gone remove immediately your right-hand glove. If you should accidentally meet the Princess Louise in the vestibule or hall she should not be addressed, merely bow. H.R.H. does not receive her guests in the hall. If you are shown into the parlor, get as far as possible from the door, that you may not be taken by surprise by so doing. The court train will probably never be worn in Canada, as it is not worn in England except at her Majesty's Drawing-rooms. The only difference I can see between visiting the late governor-general and his estimable lady and the new governor-general and his royal consort is that the right-hand glove must be taken off, and I have always argued that it should have been removed when visiting her Ladyship the Countess of Dufferin, but their Excellencies' elaborate kindness would forbid them mentioning it to any one, and I have taken it upon myself to go to England and ascertain the exact method, and it is now fully before the reader.

When the governor-general opens Parliament his Excellency will then hold a representative reception. The Princess Louise will be on his right, and the governor-general will receive the first bow, which should be properly made. I will teach any lady or gentleman in Toronto or Hamilton how to make an elaborate bow free of cost; they have but to come to my academy and they will be welcome.

Mr. Fanning's manual, though perhaps the most amusing, is not the only characteristic product of the new "viceregal" régime. The court chronicle, entitled "Lord Dufferin in Canada," has hardly a parallel in its profound adoration of grandeur unless it be that book dear to collectors of literary curiosities "The Lord Mayor's Visit to Oxford," in which the lord mayor's horses are described as pawing in proud consciousness of their august burden. The glories of the court of Ottawa are painted in the spirit of a courtier of Versailles, and a long catalogue of the ladies and gentlemen who had the immortal honor of participating is consigned to the Temple of Fame. There are two opinions, even among strong Conservatives, with regard to the wholesomeness of this "social policy," as it is styled by its devotee.

It was pleaded by the advocates of etiquette that royalty could not exist without it. In that case, royalty's chance of existence in the democratic hemisphere has been decisively shown to be poor. Some other foundation for authority must be found, and it cannot be found too soon.

It was originally intended to endow Canada with an hereditary aristocracy, but the project was blighted by the absence in these communities of hereditary wealth. Still, the attempt is made to keep up a titled class and propagate aristocratic sentiment by the bestowal of knighthood and other minor decorations. English statesmen are led by the colonists with whom they come into contact to believe that these honors are highly revered by the people, and that the impression made by them is great. Yet in Canada itself this opinion would hardly be formed. More than once knighthood has been refused by politicians who would almost certainly have been glad to accept it if they had dared, but were restrained by fear of losing their influence with the people. An article in a Conservative organ, proclaiming aristocratic principles on the occasion of a creation of knights, was found by the leaders of the party to have injured them even with their own partisans, in an election which ensued. In some instances, indeed, these titles have been so bestowed, no doubt through the governor-general's ignorance of the men about him, that to the people they must have seemed badges of anything but honor. A large portion of the Canadian press, including some highly imperialist journals, is now openly opposed to the continuance of the system.

Had an attempt to kindle Jingo sentiment in Canada been successful, the consequences might have extended beyond the colony, and have come back upon England in an unexpected way. Canadian Jingoism would have begun to spit fire at the American republic, and the ill-feeling against England in the United States, which the policy of Liberal statesmen had almost extinguished, would have been revived. The first dispute about a case of interloping in the fisheries or of contested demand for extradition might have led to a downright quarrel, in which the anti-American party in Canada would have expected to be

backed by England. This would have occurred on the eve of a presidential election, when parties in the United States were on the lookout for political capital, and the Irish, moreover, were highly excited. A spirited policy in the controversy with England would have been made a plank in political platforms, and some one more military in his disposition, and less friendly to Great Britain, than Mr. Garfield might have received the nomination at Chicago. Free trade with the United States would then have been farther off than ever. It will never be brought about by demonstrations of economical principle, even though they may be framed by so skillful a hand as that of Mr. Mongredien. The ear of the people is not open to the voice of the missionary, especially when it is supposed that national interest sends him forth. They see that under the existing system their finance flourishes and their country prospers; they are taken with the idea of fostering home industry; the immigration returns confirm their belief in the policy; and even such of them as are most concerned, the western farmers for example, do not use imported goods enough to be very sensible of the imposts. The ship-building interest, being non-existent, cannot influence the elections. The Democratic party, as a whole, has inherited free-trade tendencies from slavery, which was unable to manufacture: but it comprises a protectionist wing which will always prevent it from making free trade a square issue, as the course of events at the last presidential election showed. Moreover, manufactures are now beginning to grow up in the South, and seem likely to carry Georgia and one or two other Southern States over to the protectionist side. The only hope of a reduction of the import duties lies in the reduction of the debt, which is fast going on, and in the maintenance of kindly relations between England and the United States. It would be blasted by egging on a British dependency to place itself in an attitude of antagonism to the United States, and compelling the United States, which are now content with the smallest of peace establishments, to put their army and navy on a more costly footing.

What is the object, so far as the English people generally are concerned, of all these desperate efforts, of wasting all this

money, of running all these risks? Suppose the dreaded consummation were to arrive to-morrow. Suppose to-morrow the English-speaking race in North America were to become a single confederacy, excluding war, dedicated to industry, making an England, political and intellectual, of the New World, and linked by the bond of affection, which in the American as well as in the Canadian breast is still strong notwithstanding our family quarrels, to the common mother country. There might be mourning in the manor-houses, or in some of them, but why should there be mourning in the cottages? Why should there be mourning in those cottages from which tens of thousands are going forth every year to seek a home among their kinsmen in the United States? Surely the sentiment connected with this great moral union of all the communities of our race would be as grand as any connected with the political dominion at present exercised by the Colonial Office over a part of the colonies of England. Cromwell was not wanting either in military vigor or in high aspirations for his country, yet he, while he united Scotland and Ireland to England, treated the North American colonies virtually as independent states bound to England by the tie of the heart. The Restoration reversed both parts of his policy, dissolving the union with Scotland and Ireland, and at the same time reviving the system of interference, in the interest of monarchy, aristocracy, and the Anglican Church, with the communities on the other side of the Atlantic. How much wisdom it showed in dissolving the two unions no one needs to be told; and a short study of American and Canadian history will be sufficient to convince any one who is open to conviction that few things in history have been more calamitous than the meddling of English governments with the political development of the New World.

Not that anybody, either in Canada or in the United States, is attempting or at all wishes to precipitate the course of political events. The cry against annexation is raised by nervous imperialists who feel the action of the economical forces and ascribe it to political intrigue. Freedom in commercial intercourse with the United States is a vital necessity to Canada, which can no

more be indemnified for the want of it by an imperial Zollverein, if that scheme were feasible, than Scotland could be indemnified for want of free commercial intercourse with England. The customs line across the continent must be removed for the good of both the neighboring nations, and especially in order that the Canadian people may enjoy their full measure of prosperity, receive the fair earnings of their labor, and "eat bread unleavened by injustice." Nor can there be any doubt as to the growth in Canada of opinion favorable to commercial union. But all men of sense are contented to leave the political question to the future, feeling that it would be unwise as well as wrong to do violence to any existing sentiment, and that the indispensable condition of a change in the external relations of the country is the full and deliberate consent of the great mass of the people. There is little reason to fear that anything of this kind will be hastily done. Power is practically in the hands not of the people but of the politicians, who as a class, and without distinction of party, are naturally wedded to a system which, as has been truly said, causes Canada to grow more politics to the acre than any other country in the world. The influence of imperial honors and of English society on many of our statesmen has already been mentioned. It makes them rather servants of the British aristocracy than of the Canadian people. It is true that the people are becoming aware of the divergence between their interest and the tendencies of the politicians, and that what frightened imperialists call "a shadowy party" is beginning to appear; indeed it may be said already to have appeared in force at the last general election, when the people left the old party lines by thousands to vote for a commercial policy which they were persuaded would bring them bread. But this shadowy party seeks commercial not political objects, nor has it any one at its head who is, or is likely to be, a candidate for political power. As to American ambition, it is a mere bugbear. Even in the days of slavery and Southern rule territorial extension was sought, not so much for itself as for the purpose of maintaining the ascendancy of a party in Congress. The Americans are now, perhaps, of all

nations in the world, the least disposed to annexation. St. Domingo flung itself into the lap of the republic, and the republic shook it out again. If Mexico is annexed, as now seems likely, it will be by the commercial element in the country itself, which can no longer put up with a plundering anarchy. Had Canada been allowed to become an independent commonwealth, she would have reposed in perfect safety by the side of the more powerful republic. In many years of intercourse with Americans of all parties, the writer has never detected the slightest desire to interfere with Canadian independence. A geographical structure which, since the annexation of Manitoba and British Columbia, has truly been compared to seven fishing-rods tied together by the ends, the total want of commercial unity, and the national isolation of French Canada, which grows more French than ever, threaten the life of the confederation far more seriously than American ambition.

All that reasonable men desire is that the Canadian people shall be left free to manage their own affairs, and to shape their own destinies, in doing which England may rest assured they will never forget their filial duty toward the mother country; that British noblemen shall not be sent out, by Liberals at least, to use their influence as governors-general in propagating anti-continental sentiment; and that the earnings of Canadian labor shall not be wasted in public works undertaken for political objects, in which labor has no interest, and upon the assumption, to all appearances unfounded, of an everlasting antagonism between Canada and the United States. The imperialists, in driving Canada into a policy of boundless expenditure for their objects, are rushing to the very catastrophe which they fear: she will at length become so loaded with debt that she will no longer be mistress of her own course, and some day she will be compelled to seek admission to the Union on American terms.

The memory of Lord Lisgar's administration is treated with scorn by the admirers of the more ambitious régime which followed. Lord Lisgar was a veteran public servant, satisfied with his career; he had no objects of personal advancement, or desire to fill the papers on his own account. He was content to per-

form his allotted part without exaggerating it, and to appear as a faithful and dignified representative of the crown. He did not go on the stump, meddle with the press, or use his high station to propagate his own opinions. His influence was exercised only in teaching colonial politicians to observe English rules, and in tempering the violence of their conflicts. He was courteous, but did not hunt popularity. His hospitality was simply that of an English nobleman: it had no ulterior object, and as an example could do nothing but good. When he spoke, his words were those of sobriety and truth; nor did he ever court applause by indulging in the unmeasured flattery which is at once most seductive and most poisonous to a young nation. If among English noblemen and public men his counterpart could be found, supposing that the office is to be retained, Canada might go farther and fare worse.

There is little use in appealing to a Colonial Secretary. That office acts like a miter. Make a Low Churchman a bishop, and he is a High Churchman in a year. Make a Liberal Colonial Secretary, and he at once becomes a Jingo, of the drab, if not of the scarlet, species. But the ear of the people of England, especially of such of them as profess Liberal principles, ought at this moment to be open. They have seen in the case of South Africa, where they have been led into loss, trouble, and danger not unmingled with disgrace, what it is to allow a most virtuous and talented nobleman, of an aspiring disposition, and surrounded in the Colonial Office by a circle which applauds all his ideas, to play Providence to a country which he does not understand. They have seen what sort of information the Colonial Office gets from zealous subordinates, themselves full of high aspirations, and with titles and other rewards of activity floating before their eyes. We have already glanced at the extravagant notions which people in England have been led to entertain about the military force of Canada, and the hosts which she is ready and eager to send into the field in any English quarrel. These are hardly more wide of the truth than the accounts given by governors-general and other official persons

of the state of public sentiment in the Dominion, and especially among the French of Quebec.

Pecuniary considerations are less august than those of empire, yet they may not be without weight. English capitalists, at all events, have reason to be cautious how they send politicians in quest of a reputation to earn one by a brilliant administration of Canada. A large amount of English money, too large an amount, as some authorities assert, is invested not only in the public debt of the Dominion and in Canadian railways, but in Canadian mortgages and debentures. The farms of Ontario, as every one who has been connected with the loan societies knows, are carrying a very heavy load of mortgage debt, while their value has been reduced of late some twenty or thirty per cent, chiefly by emigration to the west. At the same time the taxes have been greatly increased. We had the other day a movement in favor of what is called a national currency—that is, a large issue of inconvertible paper money—which was strong enough to receive the amatory attentions of a considerable number of politicians, and even of organs of the government. It was checked, not so much by argument, though those of us who were true to hard money of course did our best in that way, as by a run of good harvests and a revival of commercial activity. Let there come a couple of bad harvests, with perhaps a commercial relapse, and no one will undertake to say that national currency will not sweep the country at the next election as the national policy did at the last. Monetary fallacies have misled honest men. To the mind of a farmer overloaded with mortgage debts and taxes they may find too easy an access. Once more, then, let the British investor in Canadian securities be careful how he runs Canada deeper into debt, or compromises her commercial prosperity for the purposes of imperial policy.

GOLDWIN SMITH, in *The Contemporary Review*.

JAMES A. GARFIELD.

[An Address in London, September 25, 1881.]

Ladies and gentlemen, countrymen and countrywomen—The object of this meeting, as you all know, is to testify our respect for the character and services of the late President Garfield, and in doing so to offer such consolation as is possible to a noble mother and a noble wife, suffering as few women have been called upon to suffer. It may seem a paradox, but the only alleviation of such grief is a sense of the greatness and costliness of the sacrifice that gave birth to it, and this sense is brought home to us by the measure in which others appreciate our loss. It is no exaggeration to say that the recent profoundly touching spectacle of womanly devotedness in its simplicity, its constancy, and its dignity has moved the heart of mankind in a manner without any precedent in living memory. But to Americans everywhere it comes home with a pang of mingled sorrow, pride, and unspeakable domestic tenderness that none but ourselves can feel. This pang is made more poignant by exile, and yet you will all agree with me in feeling that the universal sympathy expressed here by all classes and conditions of men has made us sensible as never before that, if we are in a strange, we are not in a foreign land, and that if we are not at home we are at least in what Hawthorne so aptly called the Old Home. I should gladly dwell more at length upon this fact, so consoling and so full of all good omen, but I must not infringe on the resolutions which will be presented to you by others. Yet I should do injustice to your feelings, no less than to my own, if I did not offer here our grateful acknowledgments to the august lady who, herself not unacquainted with grief, has shown so repeatedly and so touchingly how true a woman's heart may beat under the royal purple. On an occasion like this, when we are met together that we may give vent to a common feeling so deep and so earnest as to thrust aside every consideration of self, the wish of us all must be that what is said here should be simple, strong, and manly

as the character of the illustrious magistrate so untimely snatched from us in the very seedtime of noble purpose that would have sprung up in service as noble—that they should be as tender and true as she has shown herself to be in whose bereavement we reverently claim to share as children of the blessed country that gave birth to him and to her. We cannot find words that could reach that lofty level. This is no place for the turnings and windings of dexterous rhetoric. In the presence of that death-scene so homely, so human, so august in its unostentatious heroism, the commonplaces of ordinary eulogy stammer with the sudden shame of their own ineptitude. Were we allowed to follow the natural prompting of our hearts, we would sum up all praise in the sacred old words, "Well done, thou good and faithful servant." That death-scene was more than singular. It was unexampled. The whole civilized world was gathered about it in the breathless suspense of anxious solicitude, listened to the difficult breathing, counted the fluttering pulse, was cheered by the momentary rally and saddened by the inevitable relapse. And let us thank God and take courage when we reflect that it was through the manliness, the patience, the religious fortitude of the splendid victim that the tie of human brotherhood was thrilled to consciousness of its sacred function. The one touch of nature that makes the whole world kin is a touch of heroism, our sympathy with which dignifies and ennobles. Science has wrought no greater marvel in the service of humanity than when it gave the world a common nervous system, and thus made mankind capable of a simultaneous emotion. One remarkable feature of that death-scene was the imperturbable good-nature of the sufferer. This has been sometimes called a peculiarly American quality—a weakness if in excess or misapplied, but beautiful in its own genial place, as there and then it was. General Garfield once said to a friend, "They tell me it is a defect of my character, but I cannot hate anybody." Like Socrates, he seemed good-humored even with Death, though there have been few men from whom Death has ever wrenched a fairer heritage of opportunity. Physicians tell us that all men die well, but surely he was no ordinary

man who could die well daily for eleven agonizing weeks, and of whom it could be said at last:—

He nothing common did, or mean,
Upon that memorable scene.

A fiber capable of such strain and wear as that is used only in the making of heroic natures. Twenty years ago General Garfield offered his life to his country, and he has died for her as truly and more fruitfully now than if fate had accepted the offer then. Not only has his blood cemented our Union, but the dignity, the patience, the self-restraint, the thoughtfulness for others, the serene valor which he showed under circumstances so disheartening, and amid the wreck of hopes so splendid, are a possession and a stimulus to his countrymen forever. The emulation of examples like his makes nations great, and keeps them so. The soil out of which such men as he are made is good to be born on, good to live on, good to die for, and to be buried in.

I had not the honor of any intimacy of friendship with this noble man. Others will speak of him from more intimate knowledge. I saw him once or twice only, but so deeply was I impressed with the seriousness and solidity of his character, with his eager interest in worthy objects, and with the statesmanlike furniture of his mind, that when many years afterward he was nominated for the Presidency I rejoiced in the wisdom of the selection, and found in my memory an image of him clearer than that of any man I ever met of whom I had seen so little. And I may add that I have never known any man concerning whom a loving and admiring testimony was so uniform from men of every rank and character who had known him.

None knew him but to love him,
None named him but to praise.

I shall not trace the story of his life, but there is nothing that occurs to me so perfect in its completeness since the biblical story of Joseph. The poor lad who at thirteen could not read dies at fifty the tenant of an office second in dignity to none on earth, and the world mourns his loss as that of a personal rela-

tive. I find the word coming back to my lips in spite of me, "He was so human." An example of it was his kissing his venerable mother on the day of his inauguration. It was criticised, I remember hearing at the time, as a sin against good taste. I thought then and think now that if we had found the story in Plutarch we should have thought no worse of the hero of it. It was this pliability of his to the impulse of unconventional feeling that endeared him so much to his kind. Among the many stories that have been sent me, illustrating the sorrow so universally felt here, none have touched me so much as these two: An old gardener said to his mistress, "Oh, ma'am, we felt somehow as if he belonged to us;" and in a little village on the coast, where an evangelist held nightly service on the beach, prayer was offered regularly for the recovery of the President, and the weather-beaten fishermen who stood around the preacher with bowed, uncovered heads fervently responded "Amen."

You will also be interested to know that the benevolent Sir Moses Montefiore, now in his ninety-seventh year, telegraphed last week to Palestine to request that prayers might be offered for the President in the synagogues of the four holy cities. It was no common man who could call forth, and justly call forth, an emotion so universal, an interest so sincere and so human. I said that this was no place for eulogy. They who deserve eulogy do not need it, and they who deserve it not are diminished by it. The dead at least can bear the truth and have a right to that highest service of human speech. We are not called upon here to define Garfield's place among the memorable of mankind. A great man is made up of qualities that meet or make great occasions. We may surely say of him that the great qualities were there, and were always adequate to the need; though less fortunate than Lincoln, his career was snapped short just as they were about to be tested by the supreme trial of creative statesmanship. We believe that he would have stood the test, and we have good reason for our faith. For this is certainly true of him, that a life more strenuous, a life of more constantly heightening tendency of fulfillment, of more salutary and invigorating example, has not been lived in a coun-

try that is rich in instances of such. Well may we be proud of him, this brother of ours, recognized also as a brother wherever men honor what is praiseworthy in man. Well may we thank God for him, and love more the country that could produce and appreciate him. Well may we sorrow for his loss, but not as those without hope. Great as the loss is—and the loss of faculties trained like his is the hardest of all to replace—yet we should show a want of faith in our country if we called it irreparable. Three times within living memory has the Vice-President succeeded to the Presidential function without shock to our system, without detriment to our national honor, and without check to our prosperity. It would be an indignity to discuss here the character of him who is now our chief magistrate, and who, more than any one, it is safe to say, has felt the pain of this blow. But there is no indecorum in saying what is known to all, that he is a gentleman of culture, of admittedly high intelligence, of unimpeachable character, of proved administrative ability, and that he enters on his high duties with a full sense of what such a succession implies. I am not one of those who believe that democracy any more than any other form of government will go of itself. I am not a believer in perpetual motion in politics any more than in mechanics, but, in common with all of you, I have an imperturbable faith in the honesty, the intelligence, and the good sense of the American people, and in the destiny of the American republic.

JAMES RUSSELL LOWELL.

WORRY.

When a strong and active mind breaks down suddenly, in the midst of business, it is worn out by worry rather than overwork. Brain-labor may be too severe, or ordinary exercise prolonged until it produces serious exhaustion; but the mere draining of resources, however inexpedient, is not disease, and seldom inflicts permanent injury. A temporary collapse of the mental

powers may be caused by excessive or too continuous exertion, just as a surface well may be emptied by pumping it out more rapidly than it is refilled, but the apparatus is not thereby disorganized, and time will remedy the defect. When rest is not followed by recovery, the recuperative faculty itself, an integral part of the intellectual organism, must be impaired or disabled. This is not unfrequently the case when the possessor of a worried and weakened brain in vain seeks refuge from the supposed effects of "over-work" in simple idleness. Something more than exhaustion has occurred, and rest alone will not cure the evil. The faculty of repair is not in a condition to restore the equilibrium between potential energy and kinetic force. Divers hypotheses have been suggested to explain this state of matters. The mind has been compared to a muscle overstrained by a too violent effort, or paralyzed by excessive exertion. The two phenomena have little similarity, and no new light is thrown on the nature of mental collapse by the comparison. Perhaps a closer parallel might be found in the state which ensues when the tension of a muscular contraction is so high that spasm passes into rigidity, and molecular disorganization ensues. Meanwhile, however interesting these speculations may prove to the physiologist, they bring no relief to the sufferer. It is easy to see that a worse evil than simply using up his strength too rapidly has befallen him, but no one knows precisely what has happened. To cover the enigma, without solving it, "over-work" is taken to mean more than work over the normal in quantity, quality, and time, but no attempt is made to determine how excess in either or all of these particulars can bring about the disability and decrepitude we bewail. It is to the investigation of this mystery attention needs to be directed. If it should be possible to ascertain why a mind previously healthy, and still apparently intact, breaks down instantly and thoroughly under a strain not exceptionally great, and, collapse having once occurred, recovery follows tardily, and is rarely complete, it will probably be within the scope of common-sense to draw some practical conclusions as to the prevention, and it may be the cure, of what is in truth becoming a scourge of mental industry

already almost decimating the ranks of the army of progress in every field of intellectual enterprise at home and abroad.

A certain degree of tension is indispensable to the easy and healthful discharge of mental functions. Like the national instrument of Scotland, the mind drones wofully and will discourage most dolorous music, unless an expansive and resilient force within supplies the basis of quickly responsive action. No good, great, or enduring work can be safely accomplished by brain-force without a reserve of strength sufficient to give buoyancy to the exercise, and, if I may so say, rhythm to the operations of the mind. Working at high pressure may be bad, but working at low pressure is incomparably worse. As a matter of experience, a sense of weariness commonly precedes collapse from "over-work"; not mere bodily or nervous fatigue, but a more or less conscious distaste for the business in hand, or perhaps for some other subject of thought or anxiety which obtrudes itself. It is the offensive or irritating burden that breaks the back. Thoroughly agreeable employment, however engrossing, stimulates the recuperative faculty while it taxes the strength, and the supply of nerve-force seldom falls short of the demand. When a feeling of disgust or weariness is not experienced, this may be because the compelling sense of duty has crushed self out of thought. Nevertheless, if the will is not pleasurably excited, if it rules like a martinet without affection or interest, there is no verve, and like a complex piece of machinery working with friction and heated bearings, the mind wears itself away and a break-down ensues. Let us look a little closely at this matter.

The part which "a stock of energy" plays in brain-work can scarcely be exaggerated. Reserves are of high moment everywhere in the animal economy, and the reserve of mental force is in a practical sense more important than any other. It may happen that mere strength of mind carries a body with scarcely a vestige of power in reserve through some crisis of extraordinary difficulty, but the mental exploit is full of danger. The residual air in a lung is the basis of the respiratory process; the sustained tension of the smaller arteries transforms the pulsat-

ing current of blood thrown into the system by the heart to a continuous circulation; the equilibrated tonicity of opposing muscles gives stability to the apparatus of motion, and renders specific combinations of movement possible. What is true of the physical is also true of the mental constitution; the residual force, the tension, the tonicity of mind form the basis of intellectual action. It is not necessary to discuss the relations of mind and matter; even if the mental being is no more than a formulated expression of the physical organism, the continuity is so complete that the same laws govern both. For the purposes of the present argument it is sufficient to assert that, without a reserve of energy, healthy brain-work is impossible. Pain, hunger, anxiety, and a sense of mind-weariness are the warning tokens of exhaustion extending to the reserves. When these indications are disregarded, or destroyed, as they may be, by stupefying drugs, an inordinate use of stimulants, a strong effort of the will, or the anæsthetic effect of excessive exhaustion, the consumption of energy goes on unobserved. The feats of intellectual or physical strength, the surprising exploits of special sensation and mind-power performed by individuals under the influence of any condition which suspends the sense of pain, weakness, or fatigue, are explained by the circumstance that unsuspected reserves of power and endurance are placed at the disposal of the will. These resources were there before, but jealously guarded by the sensations. Martyrdom is possible under the influence of an overpowering abstraction. Passion may produce a similar immunity from pain, and give ability to endure even self-inflicted injury. The daily experience of lunatic asylums will abundantly attest the truth of this last assertion.

How does all this bear upon the subject? It seems rather to strengthen the position assailed by showing that "over-work" may exhaust the reserves, thereby arresting the function, and possibly destroying the integrity of the mental organism. That is undoubtedly the surface view of the case, and it is the popular explanation of what occurs. To controvert the received hypothesis is the object of the present paper. The argument, opposed to the theory of work itself exhausting the stock of

energy, may be simply stated thus: the reserves, physical and mental, are too closely guarded to be invaded by direct encroachment. Pain is not suspended by the persistent infliction of injury unless the mechanism of sensation is disabled or destroyed. Hunger does not cease until starvation has assailed the seat of nutrition. The sense of extreme weariness is not allayed by increased activity, but the longing for rest may subside, because it has been stifled by some overwhelming influence. The natural safeguards are so well fitted for their task that neither body nor mind is exposed to the peril of serious exhaustion so long as their functions are duly performed. In brief, over-work is impossible so long as the effort made is natural. When energy of any kind takes a morbid form of action, some force outside itself must be reacting upon it injuriously; and the seat of the injury, so far as the sinister influence on energy is concerned, will be found in close proximity to the sensation which under normal conditions guards the reserve. The use of stimulants in aid of work is, perhaps, one of the commonest forms of collateral influence suspending the warning sense of exhaustion. When the laborious worker, overcome with fatigue, "rouses" himself with alcohol, coffee, tea, or any other agent which may chance to suit him, he does not add a unit of force to his stock of energy, he simply narcotizes the sense of weariness, and, the guard being drugged, he appropriates the reserve. In like manner, when the dreamer and night-watcher, worn out by sleeplessness, employs opium, chloral, or some other poison to produce the semblance of repose, he stupefies the consciousness of unrest, but except in cases where it is only a habit of sleeplessness which has been contracted, and being interrupted may be broken by temporary recourse to a perilous artifice, the condition is unrelieved. Not unfrequently the warning sense is stifled by the very intensity of the motive power or impulse. Ambition, zeal, love, sometimes fear, will carry a man beyond the bounds set by nature. No matter what suspends the functions of the guard set at the threshold of the reserve, if the residual stock is touched, two consequences ensue—waste and depreciation. It is important to recognize both of

these evils. The former is generally perceived, the latter is commonly overlooked. The reserve, as we have seen, plays a double part in the economy; it is a stock in abeyance, and it is the base of every present act. Without a reserve of mental energy the mind can no more continue the healthful exercise of its functions than a flabby muscle without tonicity can respond to the stimulus of strong volition, and lift a heavy weight or strike a heavy blow.

The cause or condition which most commonly exposes the reserve of mental energy to loss and injury is worry. The tone and strength of mind are seriously impaired by its wearing influence, and if it continue long enough they will be destroyed. It sets the organism of thought and feeling vibrating with emotions which are not consonant with the natural liberation of energy in work. The whole machinery is thrown out of gear, and exercise, which would otherwise be pleasurable and innocuous, becomes painful and even destructive. It is easy to see how this must be. The longest note in music, the most steady and persistent ray of light—to use an old-fashioned expression—the tonic muscular contraction, are all, we know, produced by a rapid succession of minute motive impulses or acts, like the explosion and discharge of electricity from alternately connected and separated points in a circuit; in fact, a series of vibrations. Mental energy doubtless takes the same form of development. If a disturbing element is introduced by the obtrusion of some independent source of anxiety, or if out of the business in hand the mind makes a discord, confusion ensues, and for the time being harmonious action ceases. Working under these conditions in obedience to the will, the mental organism sustains injury which must be great, and may be lasting. The function of the warning sense is suspended; the reserve is no longer a stock in abeyance, and it ceases to give stability to the mind; the rhythm of the mental forces is interrupted; a crash is always impending, and too often sudden collapse occurs. The point to be made clear is this: over-work is barely possible, and seldom, if ever, happens, while the mind is acting in the way prescribed by its constitution, and in the nor-

mal modes of mental exercise. The moment, however, the natural rhythm of work is broken and discord ensues, the mind is like an engine with the safety-valve locked, the steam-gauge falsified, the governing apparatus out of gear; a break-down may occur at any instant. The state pictured is one of worry, and the besetting peril is not depicted in too lurid colors. The victim of worry is ever on the verge of a catastrophe; if he escape, the marvel is not at his strength of intellect so much as his good fortune. Worry is disorder, however induced, and disorderly work is abhorred by the laws of nature, which leave it wholly without remedy. The energy employed in industry carried on under this condition is lavished in producing a small result, and speedily exhausted. The reserve comes into play very early in the task, and the faculty of recuperation is speedily arrested. Sometimes loss of appetite announces the cessation of nutrition; otherwise the sense of hunger, present in the system, is for a time preternaturally acute, and marks the fact that the demand is occasioned by loss of power to appropriate, instead of any diminution of supply. The effort to work becomes daily more laborious, the task of fixing the attention grows increasingly difficult, thoughts wander, memory fails, the reasoning power is enfeebled; prejudice—the shade of defunct emotion or some past persuasion—takes the place of judgment; physical nerve or brain disturbance may supervene, and the crash will then come suddenly, unexpected by on-lookers, perhaps unperceived by the sufferer himself. This is the history of “worry,” or disorder produced by mental disquietude and distraction, occasionally by physical disease.

The first practical inference to be deduced from these considerations is that brain-work in the midst of mental worry is carried on in the face of ceaseless peril. Unfortunately work and worry are so closely connected in daily experience that they cannot be wholly separated. Meanwhile the worry of work—that which grows out of the business in hand—is generally a needless, though not always an avoidable, evil. In a large proportion of instances this description of disorder is due to the

lack of education in brain-work. Men and women, with minds capacious and powerful enough, but untrained, attempt feats for which training is indispensable, and, being unprepared, they fail. The utilitarian policy of the age is gradually eliminating from the educationary system many of the special processes by which minds used to be developed. This is, in part at least, why cases of sudden collapse are more numerous now than in years gone by. It is not, as vanity suggests, that the brain-work of to-day is so much greater than that exacted from our predecessors, but we are less well prepared for its performance. The treatment of this form of affection, the break-down from the worry of work, must be preventive; the sole remedy is the reversal of a policy which substitutes results for processes, knowledge for education. It is a serious cause of discomfiture and sorrow in work that so much of the brain-power expended is necessarily devoted to the removal of extraneous causes of worry. Labor is so fatal to life, because it is so difficult to live. The deadly peril of work in the midst of worry must be confronted, because the disturbing cause can only be got rid of by persistent labor. This is the crux of the difficulty, and in the attempt to cure the evil the struggling mind finds its fate involved in a vicious circle of morbid reactions. Nevertheless, it is the fact that work in the teeth of worry is fraught with peril, and whenever it can be avoided it should be, let the sacrifice cost what it may.

The second deduction must be, that there is no excuse for idleness in the pretense of fear of "over-work." There is some reason to apprehend that the attention recently directed to this alleged cause of mental unsoundness has not been free from a mischievous influence on minds only too ready to take refuge in any excuse for inactivity. If the private asylums of the country were searched for the victims of "over-work," they would nearly all be found to have fallen a prey to "worry," or to that degeneracy which results from lack of purpose in life and steady employment. This is a grave assertion, but it points to an evil it is especially needful to expose. Weak minds drift into dementia with wondrous celerity when they are not carried forward to

some goal, it matters little what, by the impulse of a strong motive. The bugbear of "over-work" is, it may be feared, deterring parents and friends from enforcing the need of sedulous industry on the young. The pernicious system of "cram" slays its thousands, because uneducated, undeveloped, inelastic intellects are burdened and strained with information adroitly deposited in the memory, as an expert valet packs a portmanteau, with the articles likely to be first wanted on the top. Desultory occupation, mere play with objects of which the true interest is not appreciated, ruins a still larger number; while worry, that bane of brain-work and mental energy, counts its victims by tens of thousands, a holocaust of minds sacrificed to the demon of discord, the foe of happiness, of morality, of success. The enemy takes many shapes and assumes bewildering disguises. Sometimes he comes in like a flood, hurrying everything before him, with heaps of work to be done in less than adequate time. Now the victim is hurried from task to task with a celerity fatal to sanity. Then he is chained like a galley-slave to some uncongenial labor without respite. Again, a buzz of distracting and irritating mental annoyances seem let loose to distress and distract him. Under each and all of these guises it is worry that molests, and, unless he be rescued, will ruin him. Meanwhile, the miseries of "over-work," pure and simple, are few and comparatively insignificant. Those who bewail their infliction most loudly are weak of mind or torpid of brain. Of such lame and maimed mortals we are not now thinking. Their lot may be humiliating or pitiable, as their condition is due to neglect or misfortune; but our concern is with the multitude of strong and able-minded workers who fail at their task. These are the victims not of over-work, but of worry, a foe more treacherous and merciless than all besides. The mind-cure for the malady to which "worry" gives rise, and from which so many suffer, is not idleness, or "rest," in the ordinary sense of that term, but orderly and persistent work. The work by which they have been injured has not been excessive, but bad of its kind and badly done. The palsied faculties must be strengthened and incited to healthy nutrition by new activity, at first, perhaps, administered in the

form of passive mental movement, and then induced by appropriate stimuli applied to the mind.

J. M. GRANVILLE, M.D., in *THE NINETEENTH CENTURY*.

THE HOME OF JOHN BUNYAN AT ELSTOW.

It was no doubt wrong, but it was very natural, that, in spite of Bunyan's undeniably modern date, a large portion of the attention of the Archæological Institute, at their recent meeting at Bedford, should be devoted to him; and that Elstow, the place of his birth and his home for the first thirty years of his life, should be a leading object in the excursions. Even Dean Merivale had to devote several paragraphs of his address to the local hero. As every one who made a public harangue at Athens must sing the praises of the goddess Athene, "so," the Dean remarked, "any one speaking in Bedford must magnify him whom we might almost call the patron saint, the pride and glory of the town, the famous John Bunyan." Besides the Dean's address, two of the memoirs read at the meeting were devoted to the same absorbing subject: that of the Rev. John Brown, minister of the chapel that bears Bunyan's name, on "Recent Memorials of Bunyan;" and that of the Rev. James Copner, vicar of Bunyan's native parish, on his "Connection with Elstow." The former paper presented much that was new, the result of Mr. Brown's own painstaking investigations. Mr. Brown showed that, so far from Bunyan being of gypsy descent, as an ingenious American writer has endeavored to prove, the name Bunyan, in one of its many forms, had been already known in Bedfordshire for full seven centuries, first appearing in the chronicle of Dunstable in 1219, and was repeatedly found in the Records of the Court Leet, the Registry of the Court of Probate, the accounts of the Guild of the Holy Trinity at Luton, and other mediæval documents, as well as in the parish registers of Bedford and other places in the county. "The Bunyans of Elstow—where they were living as early as 1603—appear to

have been the poor retainers of a family other branches of which were substantial yeomen in the county quite three centuries ago." The annual parochial returns of the Archdeaconry of Bedford, now for the first time examined, have supplied many hitherto unknown names and dates connected with the Bunyan family. Both the father and grandfather of John Bunyan were named Thomas. The former was baptized in February, 1603, at Elstow church, where, four-and-twenty years afterward, May 23, 1627, he took for his second wife one Margaret Bentley, John Bunyan's mother. John himself was baptized at Elstow, November 30, St. Andrew's Day, in the following year, 1628.

Mr. Brown has discovered that Bunyan lost his mother when he was between fifteen and sixteen years old, and that the congregation of which the "holy Mr. Gifford," once a debauched royalist officer, was pastor, to which Bunyan joined himself and of which he became pastor in 1672, used St. John's Church as their place of worship till the reinstatement of the Rev. Theodore Crawley, who had been ejected by the Puritans, after the Restoration in 1660. Mr. Copner's paper contained little that was new beyond some fresh scintillæ of evidence in support of his theory—ably, and we think effectually, combated by Mr. Brown, and discredited by Mr. Edward Peacock—that Bunyan was at heart a royalist, and that his seven months' soldiering was passed under the standard of Charles I., and not of the Parliament, and that he was not more than seventeen at the time of his marriage to his first wife, when, without "so much household stuff as a dish or spoon between them," the young couple began to occupy the cottage at Elstow ever since coupled with Bunyan's name.

Elstow, John Bunyan's birthplace, is a little village of old-fashioned, half-timbered cottages, with overhanging stories, projecting porches, and gabled dormers, covered with clustering roses and honeysuckles, clustering round the village green. The pedestal and stem of the ancient market-cross breaks the sward, and at the upper end of the green stands the Moot Hall, a picturesque brick and timber building of the end of the sixteenth century. The church, which rises somewhat shapeless, but not altogether undignified, on the south side of the green, is a mere

fragment of that of the nunnery founded here in 1078 for Benedictine nuns by Judith, niece to William the Conqueror, in vain atonement for the base part which she, a second "Herodias" or "Job's wife," as the Anglo-Norman Chronicle calls her, had borne with traitorous and lying tongue in the judicial murder of her husband Waltheof, Earl of Huntingdon—the greatest crime, and, we may add, the greatest blunder, in the Conqueror's life. Elstow, or, according to the ancient form found on the conventual seal, "Ellenstowe," like Bridestow, Morwenstow, Edwinstowe, and other similar names, takes its designation, the stow or place of St. Helen, from the original dedication of the church in Saxon times to St. Helena, the mother of the emperor Constantine. The Church of Rome, with her all-absorbing centralization, has ever shown herself as unfriendly to local saints as to provincial liturgies or national uses. Thus St. Guthlac was almost buried at his own Crowland beneath the later names of St. Mary and St. Bartholomew. St. Peter took precedence of St. Wilfrid at Ripon and of St. Etheldreda at Ely, while his brother-apostle St. Andrew was placed before St. David in his own cathedral of Menevia. In this way the old Saxon chapel of St. Helen became the church of St. Mary of Elstow, which in due course had to give way at the Reformation to "the Holy and Undivided Trinity."

Elstow church, in which John Bunyan was baptized and married, and where for many years he worshiped, regarding, as he tells us, with an almost superstitious reverence the "high place" and all belonging it, "priest, clerk, vestment, service, and what else," in the early days of the "Directory," is the nave of the original nunnery church, preserved at the Dissolution for the use of the parishioners, whose church it had doubtless always been, when the conventual portions were pulled down by the grantee, Sir Humphrey Ratcliffe. This was the most usual mode of dealing with monastic churches in which the parishioners had joint rights with the conventual body. The choir and transepts, with the central tower, where there was one, were pulled down by the grantee, and the materials sold or employed to erect a mansion-house hard by, while the nave was left standing. Ex-

amples of this are abundant in every part of England. It is sufficient to name Lanercost, Bridlington, Binham, Dunstable, Leominster, Waltham, and Malmesbury as typical instances. Sometimes, but much more rarely, as at Pershore, Hexham, Boxgrove, and New Shoreham, the arrangement was reversed, the parishioners becoming possessed of the eastern part by purchase or gift as their parish church, the nave, their original place of worship, being destroyed. Where the whole church is left, it is either that, as at Great Malvern and Selby, the parishioners bought the conventual church, no part of which had ever been parochial, and deserted their old parish church, which had stood quite distinct; or that, as at Sherborne, Tewkesbury, Dorchester, and other places, the church having been originally shared between the two bodies, the parishioners bought the monks' church and added to it their own. One more class remains, containing, as far as we know, only Eweny and Dunster (not to dogmatize about Arundel), where the eastern limb was simply allowed to stand, but regarded as completely distinct from the parochial portion, and allowed to fall into disuse, and consequently disrepair.

What remains of Elstow church is Norman of a very rude type in the eastern part, succeeded by four Early English bays of much better character toward the west, the building having, as usual, grown from the altar end westward. It has a lofty clerestory, with good shafted lancets at the west end. The absence of a blocked transverse arch at the east end, such as we have at Waltham Abbey and other similarly truncated buildings, seems to indicate that we do not see the whole of the structural nave, but that the conventual choir having, as usual in Norman churches, stretched over one or more bays of the western limb, these bays were included in the royal grant, and perished with the rest. Analogy would lead us safely to assert that there must have been a central tower. The existing detached belfry, the scene of Bunyan's exploits as a bell-ringer—the fourth being that which tradition asserts to have been his favorite bell—as well as of his graphically depicted struggles of conscience, when, having been convinced of the sinfulness of the

amusement, he could not refrain from going to look on till forced to flee for fear that first the bells and then the steeple should fall on his guilty head—may be the result, as at Wymondham, of some forgotten dispute between the nuns and the parishioners, or be merely, like the similar towers of Blyth, Shrewsbury, Christ Church, and elsewhere, the result of a natural desire for independence. Why it stands where it does, full seven yards from the north-west corner of the church, instead of being as usual attached to the west end, we can hardly hope to determine. Perhaps the ground to the west on which it would have been built belonged to the convent, and the ladies refused to come to terms. The tower is a massive structure, of late Perpendicular date, with widely spreading buttresses. The rough flagged floor of the belfry, bearing the marks of Bunyan's hobnailed boots, together with those of generations of ringers before and since, happily remains undisturbed, and we can only hope may escape the sweeping restoration which is now threatening to carry away much that is most characteristic in the church itself. Repair was certainly needed. Portions of the building were absolutely dangerous, and menaced a speedy ruin. The interior had a most dreary, neglected air, with whitewashed walls, and blocked up or broken windows, and square deal pews lined with fusty green baize. Dirt and squalor prevailed. When, however, we read of the removal of the roof, the pulling down and rebuilding of the clerestory and aisle walls, and the complete gutting of the church, we confess that we tremble lest we should get a new church for an old, with all reminiscences of Bunyan effectually wiped out. The advertisement by an enterprising bookselling firm of an "Elstow" edition of "The Pilgrim's Progress," literally "bound in boards" made of the oak of Elstow church, made us fear that the old seats, including Bunyan's own bench, had been cast out as so much rubbish. We are, however, glad to be assured that these are safe, and that it is only the timbers of the roof that have been thus strangely utilized. The lovely little fourteenth-century apartment, groined from a central shaft, attached to the west end of the south aisle, popularly known as the "nuns' choir," and sometimes, but

erroneously, supposed to have been the chapter-house, is, we are told, receiving careful treatment, the injured vaulting being restored stone by stone. The singular molded brackets connecting the vaulting ribs with the capital in this room are probably unique. Their loss would be irreparable.

To the south of the church the remains of the Jacobean mansion of the Hillesdens, pieced on to the walls of the nunnery, with their ivy-draped mullioned windows and little domestic chapel wreathed with foliage, form a very picturesque feature. It must have been a grand new house in Bunyan's early days. The cottage where Bunyan was born cannot be identified. That occupied by him after his first marriage, where his children were born and the fierce spiritual conflicts were waged, narrated in his "Grace Abounding," is pointed out, but alterations and repairs have made it essentially a modern building. Here in the time of the late Dean Bowers of Manchester, who was formerly rector of Elstow, the very forge used to be shown at which Bunyan worked. This, too, has now passed away. Bunyan was living here in April, 1654, when his daughter Elizabeth, who died in childhood, was born. Between that year and 1660 he must have left his native village and gone to reside at Bedford, where he is stated to be living in his indictment of that year. The site of the house in Cuthbert Street in which he resided after his release in 1672 till his death is still pointed out. As is well known, twelve years of Bunyan's Bedford life were spent in jail, at one time making tagged laces for the support of his family, at another writing the work which, little as he could then have anticipated it, has been translated into almost every language of the civilized world—the Bunyan library contains a translation into Chinese with Japanese illustrations—and has made his name immortal. This jail, the "Den," as he calls it in the opening words of his "Pilgrim's Progress," was not, as sensational writers have loved to represent it, the damp and stifling dungeon on the central pier of Old Bedford Bridge, which was nothing more than a mere town lock-up for casual vagrants, but in the county jail standing between High Street and Silver Street. This has now been pulled down, and its site

has become an open market, and only a small fragment of its side wall remains for the gratification of pilgrims. "Bunyan Meeting" contains a curious museum of miscellaneous articles, such as his apple-scoop, penknives, scales for testing the weight of the coins paid him, a curious little cabinet with nests of drawers, and the solid oaken chair with carved legs in which he used to sit. The most interesting of these memorials is the "Church Book," containing the records of the Baptist congregation of which Bunyan had been appointed pastor on the 21st of January, 1672, the year of his liberation from his twelve years' imprisonment. His formal pardon under the Great Seal was not issued until the 13th of September of that year. But on the 9th of the preceding May he had received a license to preach, among about three thousand other nonconformist teachers, and during this interval his incarceration was merely nominal. This year is celebrated in the annals of nonconformity as "the year of liberation." The Cabal Ministry were preparing for a new war with Holland, to avenge the insults and injuries of 1666. Though they had no love for sectarians, it was expedient to conciliate them, that the difficulties of a foreign campaign might not be aggravated by internal dissensions. So the famous "Declaration of Indulgence" was published by royal authority; and, in Mr. J. R. Green's words, "ministers returned after years of banishment to their houses and to their flocks; chapels were reopened; the jails were emptied; Bunyan left his prison at Bedford, the 'Den' where he had been visited with his marvelous dream." The first entry in the "Church Book" is not dated at Bedford, but at the neighboring village of Gamlingay, where, before his imprisonment, Bunyan had laid the foundations of a congregation, and records the propounding of the desire of "Sister Behemont to walke in fellowship." As the contrary is not stated, we may conclude that the desire of the fair sister—whose name, so queerly suggestive of the huge water-beast of the Book of Job, is merely a phonetic form of Beaumont—was granted. A subsequent entry, however, the first in Bunyan's own handwriting, tells us how "at a full assembly of the Congregation was with joynt consent of the whole Body cast out of the

Church John Rush of Bedford for being drunke after a very beastly and filthy manner, that is"—the definiteness is worth remarking—"above the ordinary rate of drunkerds; for he was not carried home from the 'Swan' to his own house without the help of no less than three persons, who when they had brought him home could not present him as one alive to his familie, he was so dead drunke." This Church Book, kept continuously down to the present day, abounds in curious entries throwing light on nonconformist religious life. We are surprised it has not been printed.

Another interesting document among the Bunyan papers, the only holograph known, is what is erroneously known as "Bunyan's Will." It is dated December 23, 1685, the year of Monmouth's rebellion, and is really a deed of gift to his wife Elizabeth, executed when he thought he should probably have to go to jail again for suspected complicity in Monmouth's designs, with the forfeiture of all his little property. In this, describing himself as "J. Bunyan, of the parish of St. Cuthbirts in the toune of Bedford, Brazier," he makes over to her "all and singular my goods, chattels, debts, ready money, plate, rings, household stuffe, apparel, utensills, brass, peuter, bedding, and all other my substance whatsoever, moueable and immoueable.' The "oncoyned peece of silver commonly called twopence," which, as a caparra or handsell, had been affixed to the seal to put Mrs. Bunyan "in peaceable and quiet possession," has unfortunately been lost. Bunyan's fears of further annoyance proved groundless; and though he was sometimes driven to adopt disguises to escape threatened danger—the tradition is that he used to go to Reading to preach in a wagoner's frock, with a long whip in his hand—his liberty was never again restrained, and he lived unmolested to within three months of the revolution. As is well known, he died at the house of a friend, Mr. Strudwick, a shopkeeper on Holborn Bridge, August 31, 1688, of a cold and fever caught in a wet ride from Reading, where he had been to reconcile a father and son. By a happy chance, Mr. Brown has secured one of the worthy tradesman's bills, made out to "Lord James Radcliffe"—afterward the Lord Derwëntwater who suf-

ferred in 1716—with a wood-cut of the four-storied gabled house, such as the older of us can remember many of in the back streets of London, in which Bunyan died. The billhead runs:—"Bought of John Strudwick, at the sign of the Star, Holborne Bridge, Grocer and Chandler." The copy of Foxe's "Acts and Monuments," or "Book of Martyrs," as it is popularly called, which was Bunyan's companion and daily study in prison, is preserved in the Town Library. Bunyan's signature at the foot of the title-page is laboriously formed in large ill-shaped printing characters, with the date 1662, the work of one by whom the art of writing, if he had ever acquired it, had been almost entirely lost. The margins of some of the ghastly wood-cuts of burnings, etc., are scrawled over with rude doggerel rhymes such as the following:—

Hear is one stout and strong indeed;
He doth not waver like as doth Reed.

Certainly Bunyan improved greatly both as a penman and a poet before he wrote "The Deed of Gift" already described, and composed that little lyrical gem in the second part of "The Pilgrim's Progress," recalling Amiens's song in "As You Like It":—

Who would true Valour see
Let him come hither;
One here will constant be,
Come snow, come weather.
There's no Discouragement
Shall make him once relent
His first avowed Intent
To bee a Pilgrim.

THE SATURDAY REVIEW.

FICTION—FAIR AND FOUL.

FIFTH PAPER.—THE TWO SERVANTS.

I have assumed throughout these papers, that everybody knew what Fiction meant, as Mr. Mill assumed in his "Political Economy" that everybody knew what wealth meant. The assumption was convenient to Mr. Mill, and persisted in; but,

for my own part, I am not in the habit of talking, even so long as I have done in this instance, without making sure that the reader knows what I am talking about; and it is high time that we should be agreed upon the primary notion of what Fiction is.

A feigned, fictitious, artificial, super-natural, put-together-out-of-one's-head thing. All this it must be, to begin with. The best type of it being the most practically fictile—a Greek vase. A thing which has two sides to be seen, two handles to be carried by, and a bottom to stand on, and a top to be poured out of, this every right fiction is, whatever else it may be. Planned rigorously, rounded smoothly, balanced symmetrically, handled handily, lipped softly for pouring out oil and wine. Painted daintily at last with images of eternal things—

Forever shalt thou love, and she be fair.

Quite a different thing from a "cast"—this work of clay in the hands of the potter, as it seemed good to the potter to make it. Very interesting a cast from life may perhaps be; more interesting to some people, perhaps, a cast from death;—most modern novels are like specimens from Lyme Regis, impressions of skeletons in mud.

"Planned rigorously"—I press the conditions again one by one—it must be as ever Memphian labyrinth or Norman fortress. Intricacy full of delicate surprise; covered way in secrecy of accurate purposes, not a stone useless, nor a word nor an incident thrown away.

"Rounded smoothly"—the wheel of Fortune revolving with it in unfelt swiftness; like the world, its story rising like the dawn, closing like the sunset, with its own sweet light for every hour.

"Balanced symmetrically"—having its two sides clearly separate, its war of good and evil rightly divided. Its figures moving in majestic law of light and shade.

"Handled handily"—so that, being careful and gentle, you can take easy grasp of it and all that it contains; a thing given into your hand thenceforth to have and to hold. Comprehensible, not a mass that both your arms cannot get round; tenable,

not a confused pebble-heap of which you can only lift one pebble at a time.

"Lipped softly"—full of kindness and comfort: the Keats line indeed the perpetual message of it—"Forever shalt thou love, and she be fair." All beautiful fiction is of the Madonna, whether the Virgin of Athens or of Judah—pan-Athenaic always.

And all foul fiction is leze-majesté to the Madonna and to womanhood. For indeed the great fiction of every human life is the shaping of its Love, with due prudence, due imagination, due persistence and perfection from the beginning of its story to the end; for every human soul its palladium. And it follows that all right imaginative work is beautiful, which is a practical and brief law concerning it. All frightful things are either foolish or sick, visits of frenzy or pollutions of plague.

Taking thus the Greek vase at its best time for the symbol of fair fiction: of foul, you may find in the great entrance-room of the Louvre, filled with the luxurious orfèvrerie of the sixteenth century, types perfect and innumerable: Satyrs carved in serpentine, Gorgons platted in gold, Furies with eyes of ruby, Scyllas with scales of pearl; infinitely worthless toil, infinitely witless wickedness; pleasure satiated into idiocy, passion provoked into madness, no object of thought, or sight, or fancy, but horror, mutilation, distortion, corruption, agony of war, insolence of disgrace, and misery of Death.

It is true that the ease with which a serpent, or something that will be understood for one, can be chased or wrought in metal; and the small workmanly skill required to image a Satyr's hoof and horns, as compared to that needed for a human foot or forehead, have greatly influenced the choice of subject by incompetent smiths; and in like manner, the prevalence of such vicious or ugly story in the mass of modern literature is not so much a sign of the lasciviousness of the age as of its stupidity, though each react on the other, and the vapor of the sulphurous pool becomes at last so diffused in the atmosphere of our cities, that whom it cannot corrupt it will at least stultify.

Yesterday, the last of August, came to me, from the Fine Art

Society, a series of twenty black and white scrabbles* of which I am informed in an eloquent preface that the author was a Michael Angelo of the glebe, and that his shepherds and his herdswomen are akin in dignity and grandeur to the prophets and Sibyls of the Sistine.

Glancing through the series of these stupendous productions, I find one peculiarly characteristic and expressive of modern picture-making and novel-writing—called "Hauling," or more definitely "Paysan rentrant du Fumier," which represents a man's back, or at least the back of his waistcoat and trousers, and hat, in full light, and a small blot where his face should be, with a small scratch where its nose should be, elongated into one representing a chink of timber in the background.

Examining the volume farther, in the hope of discovering some trace of reasonable motive for the publication of these works by the society, I perceive that this Michael Angelo of the glebe had indeed natural faculty of no mean order in him, and that the woful history of his life contains very curious lessons respecting the modern conditions of Imagination and Art.

I find, in the first place, that he was a Breton peasant; his grandmother's godson, baptized in good hope, and

christened Jean, after his father, and François after the Saint of Assisi, his god-mother's patron. It was under her care and guidance and those of his uncle, the Abbé Charles, that he was reared; and the dignified and laborious earnestness of these governors of his was a chief influence in his life, and a distinguishing feature in his character. The Millet family led an existence almost patriarchal in its unalterable simplicity and diligence; and the boy grew up in an environment of toil, sincerity, and devoutness. He was fostered upon the Bible and the great book of nature. . . . When he woke, it was to the lowing of cattle and the song of birds; he was at play all day, among "the sights and sounds of the open landscape;" and he slept with the murmur of the spinning-wheel in his ears, and the memory of the evening prayer in his heart. . . . He learned Latin from the parish priest, and from his uncle Charles; and he soon came to be a student of Virgil, and while yet young in his teens began to follow his father out into the fields, and thenceforward, as became the eldest boy in a large family, worked hard at grafting and plowing, sowing and reaping, scything and shearing and planting, and all the many duties of husbandmen. Meanwhile, he had taken to drawing, . . . copied everything he

* Jean François Millet. Twenty Etchings and Woodcuts reproduced in Facsimile, and Biographical Notice by William Ernest Henley. London, 1881.

saw, and produced not only studies but compositions also; until at last his father was moved to take him away from farming, and have him taught painting.

Now all this is related concerning the lad's early life by the prefatory and commenting author, as if expecting the general reader to admit that there had been some advantage for him in this manner of education:—that simplicity and devoutness are wholesome states of mind; that parish curés and uncle abbés are not betrayers or devourers of youthful innocence; that there is profitable reading in the Bible, and something agreeably soothing, if not otherwise useful, in the sound of evening prayer. I may observe also, in passing, that his education, thus far, is precisely what for the last ten years I have been describing as the most desirable for all persons intending to lead an honest and Christian life (my recommendation that peasants should learn Latin having been, some four or five years ago, the subject of much merriment in the pages of *Judy* and other such nurses of divine wisdom in the public mind). It, however, having been determined by the boy's father that he should be a painter, and that art being unknown to the Abbé Charles and the village curé (in which manner of ignorance, if the infallible pope did but know it, he and his now artless shepherds stand at a fatal disadvantage in the world, as compared with monks who could illuminate with color as well as word), the simple young soul is sent for the exalting and finishing of its artistic faculties to Paris.

"Wherein," observes my prefatory author, "the romantic movement was in the full tide of prosperity."

Hugo had written "*Notre Dame*," and Musset had published "*Rolla*" and the "*Nuits*;" Balzac the "*Lys dans la Vallée*;" Gautier the "*Comédie de la Mort*;" Georges Sand "*Léone Léonie*;" and a score of wild and eloquent novels more; and under the instruction of these romantic authors, his landlady, to whom he had intrusted the few francs he possessed, to dole out to him as he needed, fell in love with him, and finding he could not, or would not, respond to her advances, confiscated the whole deposit, and left him penniless. The preface goes on to tell us how, not feeling himself in harmony with these forms of romanticism, he takes to the study of the Infinite and Michael

Angelo; how he learned to paint the Heroic Nude; how he mixed up for imitation the manners of Rubens, Ribera, Mantegna, and Correggio; how he struggled all his life with neglect, and endured with his family every agony of poverty; owed his butcher and his grocer, was exposed to endless worry and annoyance from writs and executions; and when first his grandmother died, and then his mother, for neither deathbed was able to raise the money that would have carried him from Barbizon to Gruchy.

The work now laid before the public by the Fine Art Society is to be considered, therefore—whatever its merits or defects may be—as an expression of the influence of the Infinite and Michael Angelo on a mind innocently prepared for their reception. And in another place I may take occasion to point out the peculiar adaptability of modern etching to the expression of the Infinite, by the multitude of scratches it can put on a surface without representing anything in particular; and to illustration of the majesty of Michael Angelo by preference of the backs and legs of people to their faces.

But I refer to the book in this paper, partly indeed because my mind is full of its sorrow, and I may not be able to find another opportunity of saying so; but chiefly because the author of the preface has summed the principal authors of depraved fiction in a single sentence; and I want the reader to ask himself why, among all the forms of the picturesque which were suggested by this body of literary leaders, none were acceptable by, none helpful to, the mind of a youth trained in purity and faith.

He will find, if he reflect, that it is not in romantic or any other healthy aim that the school detaches itself from those called sometimes by recent writers "classical"; but first by Infidelity, and an absence of the religious element so total that at last it passes into the hatred of priesthood which has become characteristic of republicanism; and secondly by the taint and leprosy of animal passion idealized as a governing power of humanity, or at least used as the chief element of interest in the conduct of its histories. It is with the "Sin of Master Anthony"

that Georges Sand (who is the best of them) overshadows the entire course of a novel meant to recommend simplicity of life—and by the weakness of "Consuelo" that the same authoress thinks it natural to set off the splendor of the most exalted musical genius.

I am not able to judge of the degree of moral purpose, or conviction, with which any of the novelists wrote. But I am able to say with certainty that, whatever their purpose, their method is mistaken, and that no good is ever done to society by the pictorial representation of its diseases.

All healthy and helpful literature sets simple bars between right and wrong; assumes the possibility, in men and women, of having healthy minds in healthy bodies, and loses no time in the diagnosis of fever or dyspepsia in either; least of all in the particular kind of fever which signifies the ungoverned excess of any appetite or passion. The "dullness" which many modern readers inevitably feel, and some modern blockheads think it creditable to allege, in Scott, consists not a little in his absolute purity from every loathsome element or excitement of the lower passions; so that people who live habitually in Satyric or hircine conditions of thought find him as insipid as they would a picture of Angelico's. The accurate and trenchant separation between him and the common railroad-station novelist is that, in his total method of conception, only lofty character is worth describing at all; and it becomes interesting, not by its faults, but by the difficulties and accidents of the fortune through which it passes, while in the railway novel interest is obtained with the vulgar reader for the vilest character, because the author describes carefully to his recognition the blotches, burs, and pimples in which the paltry nature resembles his own. The "Mill on the Floss" is perhaps the most striking instance extant of this study of cutaneous disease. There is not a single person in the book of the smallest importance to anybody in the world but themselves, or whose qualities deserved so much as a line of printer's type in their description. There is no girl alive, fairly clever, half educated, and unluckily related, whose life has not at least as much in it as Maggie's to be described and

to be pitied. Tom is a clumsy and cruel lout, with the making of better things in him (and the same may be said of nearly every Englishman at present smoking and elbowing his way through the ugly world his blunders have contributed to the making of); while the rest of the characters are simply the sweepings-out of a Pentonville omnibus.*

And it is very necessary that we should distinguish this essentially cockney literature—developed only in the London suburbs, and feeding the demand of the rows of similar brick houses, which branch in devouring cancer round every manufacturing town—from the really romantic literature of France. Georges Sand is often immoral; but she is always beautiful, and in the characteristic novel I have named, "*Le Péché de Mons. Antoine*," the five principal characters, the old Cavalier Marquis, the Carpenter, M. de Chateaubrun, Gilberte, and the really passionate and generous lover, are all as heroic and radiantly ideal as Scott's Colonel Mannering, Catherine Seyton, and Roland Graeme; while the landscape is rich and true with the emotion of years of life passed in glens of Norman granite and beside bays of Italian sea. But in the English cockney school, which consummates itself in George Eliot, the personages are picked up from behind the counter and out of the gutter; and the landscape, by excursion train to Gravesend, with return ticket for the City-road.

But the second reason for the dullness of Scott to the uneducated or miseducated reader lies far deeper; and its analysis is related to the most subtle questions in the Arts of Design.

The mixed gayety and gloom in the plan of any modern novel fairly clever in the make of it may be likened, almost with precision, to the patchwork of a harlequin's dress, well spangled; a pretty thing enough, if the human form beneath it be graceful and active. Few personages on the stage are more delightful to me than a good harlequin; also, if I chance to have noth-

* I am sorry to find that my former allusion to the boating expedition in this novel has been misconstrued by a young authoress of promise into disparagement of her own work, not supposing it possible that I could only have been forced to look at George Eliot's by a friend's imperfect account of it.

ing better to do, I can still read my Georges Sand or Alfred de Musset with much contentment, if only the story end well.

But we must not dress Cordelia or Rosalind in robes of triangular patches, covered with spangles, by way of making the coup d'œil of them less dull; and so the story-telling of Scott is like the robe of the Sistine Zipporah—embroidered only on the edges with gold and blue, and the embroidery involving a legend written in mystic letters.

And the interest and joy which he intends his reader to find in his tale are in taking up the golden thread here and there in its intended recurrence—and following, as it rises again and again, his melody through the disciplined and unaccented march of the fugue.

Thus the entire charm and meaning of the story of the Monastery depend on the degree of sympathy with which we compare the first and last incidents of the appearance of a character whom perhaps not one in twenty readers would remember as belonging to the *dramatis personæ*—Stawarth Bolton.

Childless, he assures safety in the first scene of the opening tale to the widow of Glendinning and her two children—the elder boy challenging him at the moment, “I will war on thee to the death, when I can draw my father’s sword.” In virtually the last scene, the grown youth, now in command of a small company of spearmen in the Regent Murray’s service, is on foot; in the first pause after the battle at Kennaquhair, beside the dead bodies of Julian Avenel and Christie, and the dying Catherine.*

Glendinning forgot for a moment his own situation and duties, and was first recalled to them by a trampling of horse, and the cry of St. George for England, which the English soldiers still continued to use. His handful of men, for most of the stragglers had waited for Murray’s coming up, remained on horseback, holding their lances upright, having no command either to submit or resist.

“There stands our captain,” said one of them, as a strong party of English came up, the vanguard of Foster’s troop.

“Your captain! with his sword sheathed, and on foot in the presence of his

* I am ashamed to exemplify the miserable work of “review” by mangling and mumbling this noble closing chapter of the “Monastery,” but I cannot show the web of work without unweaving it.

enemy? a raw soldier, I warrant him," said the English leader. "So! ho! young man, is your dream out, and will you now answer me if you will fight or fly?"

"Neither," answered Halbert Glendinning, with great tranquillity.

"Then throw down thy sword and yield thee," answered the Englishman.

"Not till I can help myself no otherwise," said Halbert, with the same moderation of tone and manner.

"Art thou for thine own hand, friend, or to whom dost thou owe service?" demanded the English captain.

"To the noble Earl of Murray."

"Then thou servest," said the Southron, "the most disloyal nobleman who breathes—false both to England and Scotland."

"Thou liest," said Glendinning, regardless of all consequences.

"Ha! art thou so hot now, and wert so cold but a minute since? I lie, do I? Wilt thou do battle with me on that quarrel?"

"With one to one, one to two, or two to five, as you list," said Halbert Glendinning; "grant me but a fair field."

"That thou shalt have. Stand back, my mates," said the brave Englishman. "If I fall, give him fair play, and let him go off free with his people."

"Long life to the noble captain!" cried the soldiers, as impatient to see the duel as if it had been a bull-baiting.

"He will have a short life of it, though," said the sergeant, "if he, an old man of sixty, is to fight for any reason, or for no reason, with every man he meets, and especially the young fellows he might be father to. And here comes the warden, besides, to see the sword-play."

In fact, Sir John Foster came up with a considerable body of his horsemen, just as his captain, whose age rendered him unequal to the combat with so strong and active a youth as Glendinning, lost his sword.*

"Take it up for shame, old Stawarth Bolton," said the English warden; "and thou, young man, get you gone to your own friends, and loiter not here."

Notwithstanding this peremptory order, Halbert Glendinning could not help stopping to cast a look upon the unfortunate Catherine, who lay insensible of the danger and of the trampling of so many horses around her—insensible, as the second glance assured him, of all and forever. Glendinning almost rejoiced when he saw that the last misery of life was over, and that the hoofs of the war-horses, among which he was compelled to leave her, could only injure and deface a senseless corpse. He caught the infant from her arms, half ashamed of the shout of laughter which rose on all sides, at seeing an armed man in such a situation assume such an unwonted and inconvenient burden.

"Shoulder your infant!" cried an arquebusier.

"Port your infant!" said a pikeman.

"Peace, ye brutes!" said Stawarth Bolton, "and respect humanity in others, if you have none yourselves. I pardon the lad having done some discredit to my gray hairs, when I see him take care of that helpless creature, which ye would have trampled upon as if ye had been littered of bitch-wolves, not born of women."

The infant thus saved is the heir of Avenel, and the intricacy and fateful bearing of every incident and word in the scene,

* With ludicrously fatal retouch in the later edition "was deprived of" his sword.

knitting into one central moment all the clews to the plot of two romances, as the rich boss of a Gothic vault gathers the shaft moldings of it, can only be felt by an entirely attentive reader; just as (to follow out the likeness on Scott's own ground) the willow-wreaths changed to stone of Melrose tracery can only be caught in their plighting by the keenest eyes. The meshes are again gathered by the master's own hand when the child now in Halbert's arms, twenty years hence, stoops over him to unlace his helmet, as the fallen knight lies senseless on the field of Carberry Hill.*

But there is another, and a still more hidden, method in Scott's designing of story, in which, taking extreme pains, he counts on much sympathy from the reader, and can assuredly find none in a modern student. The moral purpose of the whole, which he asserted in the preface to the first edition of "*Waverley*," was involved always with the minutest study of the effects of true and false religion on the conduct; which subject being always touched with his utmost lightness of hand and stealthiness of art, and founded on a knowledge of the Scotch character and the human heart, such as no other living man possessed, his purpose often escapes first observation as completely as the inner feelings of living people do; and I am myself amazed, as I take any single piece of his work up for examination, to find how many of its points I had before missed or disregarded.

The groups of personages whose conduct in the Scott romance is definitely affected by religious conviction may be arranged broadly, as those of the actual world, under these following heads:—

1. The lowest group consists of persons who, believing in the general truths of evangelical religion, accommodate them to their passions, and are capable, by gradual increase in depravity, of any crime or violence. I am not going to include these in our present study. Trumbull ("*Redgauntlet*"), Trusty Tomkyns ("*Woodstock*"), Burley ("*Old Mortality*"), are three of the principal types.

* Again I am obliged, by review necessity, to omit half the points of the scene.

2. The next rank above these consists of men who believe firmly and truly enough to be restrained from any conduct which they clearly recognize as criminal, but whose natural selfishness renders them incapable of understanding the morality of the Bible above a certain point; and whose imperfect powers of thought leave them liable in many directions to the warping of self-interest or of small temptations.

Fairservice. Blattergowl. Kettledrummy. Gifted Gilfillan.

3. The third order consists of men naturally just and honest, but with little sympathy and much pride, in whom their religion, while in the depth of it supporting their best virtues, brings out on the surface all their worst faults, and makes them censorious, tiresome, and often fearfully mischievous.

Richie Moniplies. Davie Deans. Mause Hedrigg.

4. The enthusiastic type, leading to missionary effort, often to martyrdom.

Warden, in "Monastery." Colonel Gardiner. Ephraim Macbriar. Joshua Geddes.

5. Highest type, fulfilling daily duty; always gentle, entirely firm, the comfort and strength of all around them; merciful to every human fault, and submissive without anger to every human oppression.

Rachel Geddes. Jeanie Deans. Bessie Maclure, in "Old Mortality"—the queen of all.

In the present paper I ask the reader's patience only with my fulfillment of a promise long since made, to mark the opposition of the effects of an entirely similar religious faith in two men of inferior position, representing in perfectness the commonest types in Scotland of the second and third order of religionists here distinguished, Andrew Fairservice ("Rob Roy") and Richie Moniplies ("Nigel").

The names of both the men imply deceitfulness of one kind or another—Fairservice, as serving fairly only in pretense; Moniplies, as having many windings, turns, and ways of escape. Scott's names are themselves so Moniplied that they need as much following out as Shakespeare's; and as their roots are pure Scotch, and few people have a good Scottish glossary be-

side them, or would use it if they had, the novels are usually read without any turning of the first keys to them. I did not myself know till very lately the root of Dandie Dinmont's name—"Dinmont," a two-year-old sheep; still less that of Moniplies, which I had been always content to take Master George Heriot's rendering of: "This fellow is not ill-named—he has more plies than one in his cloak." ("Nigel," i. 72.) In its first sense, it is the Scotch word for tripe, Moniplies being a butcher's son.

Cunning, then, they both are, in a high degree—but Fairservice only for himself, Moniplies for himself and his friend; or, in grave business, even for his friend first. But it is one of Scott's first principles of moral law that cunning never shall succeed, unless definitely employed against an enemy by a person whose essential character is wholly frank and true; as by Roland against Lady Lochleven, or Mysie Happer against Dan of the Howlet-hirst; but consistent cunning in the character always fails: Scott allows no Ulyssean hero.

Therefore the cunning of Fairservice fails always, and totally; but that of Moniplies precisely according to the degree of its selfishness: wholly in the affair of the petition—"I am sure I had a' the right and a' the risk," i. 73)—partially in that of the carcanet. This he himself at last recognizes with complacency:—

"I think you might have left me," says Nigel, in their parting scene (i. 286), "to act according to my own judgment."

"Mickle better not," answered Richie; "mickle better not. We are a' frail creatures, and can judge better for ilk ither than in our own cases. And for me—even myself—I have always observed myself to be much more prudential in what I have done in your lordship's behalf than even in what I have been able to transact for my own interest—whilk last I have, indeed, always postponed, as in duty I ought."

"I do believe thou hast," answered Lord Nigel, "having ever found thee true and faithful."

And his final success is entirely owing to his courage and fidelity, not to his cunning.

To this subtlety both the men join considerable power of penetration into the weaknesses of character; but Fairservice only sees the surface-failings, and has no respect for any kind of

nobleness; while Richie watches the gradual lowering of his master's character and reputation with earnest sorrow.

"My lord," said Richie, "to be round with you, the grace of God is better than gold pieces, and if they were my last words," he said, raising his voice, "I would say you are misled, and are forsaking the paths your honorable father trode in; and what is more, you are going—still under correction—to the devil with a dish-clout, for ye are laughed at by them that lead you into these disordered bypaths" (i. 282).

In the third place, note that the penetration of Moniplies,—though, as aforesaid, more into faults than virtues,—being yet founded on the truth of his own nature, is undeceivable. No rogue can escape him for an instant; and he sees through all the machinations of Lord Glenvarloch's enemies from the first; while Fairservice, shrewd enough in detecting the follies of good people, is quite helpless before knaves, and is deceived three times over by his own chosen friends—first by the lawyer's clerk, Touthope (ii. 21), then by the hypocrite Mac Vittie, and finally by his true blue Presbyterian friend Laurie.

In these first elements of character the men are thus broadly distinguished; but in the next, requiring analysis, the differences are much more subtle. Both of them have, in nearly equal degree, the peculiar love of doing or saying what is provoking, by an exact contrariety to the wishes of the person they are dealing with, which is a fault inherent in the rough side of uneducated Scottish character; but in Andrew the habit is checked by his self-interest, so that it is only behind his master's back that we hear his opinion of him; and only when he has lost his temper that the inherent provocativeness comes out—(see the dark side into Scotland).

On the contrary, Moniplies never speaks but in praise of his absent master; but exults in mortifying him in direct colloquy; yet never indulges this amiable disposition except with a really kind purpose, and entirely knowing what he is about. Fairservice, on the other hand, gradually falls into an unconscious fatality of varied blunder and provocation; and at last causes the entire catastrophe of the story by bringing in the candles when he has been ordered to stay downstairs.

We have next to remember that with Scott truth and cour-

age are one. He somewhat overvalued animal courage, holding it the basis of all other virtue; in his own words, "Without courage there can be no truth, and without truth no virtue." He would, however, sometimes allow his villains to possess the basis without the superstructure, and thus Rashleigh, Dalgarno, Balfour, Varney, and other men of that stamp are to be carefully distinguished from his erring heroes, Marmion, Bertram, Christie of the Clinthill, or Nanty Ewart, in whom loyalty is always the real strength of the character, and the faults of life are owing to temporary passion or evil fate. Scott differs in this standard of heroism materially from Byron,* in whose eyes mere courage, with strong affections, are enough for admiration; while Bertram, and even Marmion, though loyal to his country, are meant only to be pitied—not honored. But neither Scott nor Byron will ever allow any grain of mercy to a coward; and the final difference, therefore, between Fairservice and Monipplies, which decides their fate in Scott's hands, is that between their courage and cowardice. Fairservice is driven out at the kitchen door, never to be heard of more, while Richie rises into Sir Richie of Castle-Collop,—the reader may perhaps at the moment think by too careless grace on the King's part; which, indeed, Scott in some measure meant;—but the grotesqueness and often evasiveness of Richie's common manner make us forget how surely his bitter word is backed by his ready blow, when need is. His first introduction to us (i. 33) is because his quick temper overcomes his caution:—

"I thought to mysel', 'Ye are owre mony for me to mell with; but let me catch ye in Barford's Park, or at the fit of the vennel, I could gar some of ye sing another sang.' Sae, ae auld hirpling deevil of a potter behoved just to step in my way and offer me a pig, as he said, just to pit my Scotch ointment in, and I gave him a push, as but natural, and the tottering deevil couped owre amang his ain pigs, and damaged a score of them. And then the reird † raise!"—

* I must deeply and earnestly express my thanks to my friend Mr. Hale White for his vindication of Goethe's real opinion of Byron from the mangled representation of it by Mr. Matthew Arnold (*Contemporary Review*, August, 1881).

† "Reirde, rerde, Anglo-Saxon reord, lingua, sermo, clamor, shouting" (*Douglas glossary*). No Scottish sentence in the Scott novels should be passed without examining every word in it, his dialect, as already noticed, being always pure and

while in the close of the events (ii. 365) he wins his wife by a piece of hand-to-hand fighting, of the value of which his cool and stern estimate, in answer to the gay Templar, is one of the great sentences marking Scott's undercurrent of two feelings about war, in spite of his love of its heroism.

"Bravo, Richie," cried Lowestoffe, "why, man, there lies Sin struck down like an ox, and Iniquity's throat cut like a calf."

"I know not why you should upbraid me with my upbringing, Master Lowestoffe," answered Richie with great composure; "but I can tell you, the shambles is not a bad place for training one to this work."

These then being the radical conditions of native character in the two men, wholly irrespective of their religious persuasion, we have to note what form their Presbyterian faith takes in each, and what effect it has on their consciences.

In Richie it has little to do; his conscience being, in the deep of it, frank and clear. His religion commands him nothing which he is not at once ready to do, or has not habitually done; and it forbids him nothing which he is unwilling to forego. He pleads no pardon from it for known faults; he seeks no evasions in the letter of it for violations of its spirit. We are scarcely therefore aware of its vital power in him, unless at moments of very grave feeling and its necessary expression.

"Wherefore, as the letter will not avail you with him to whom it is directed, you may believe that Heaven hath sent it to me, who have a special regard for the writer—have besides, as much mercy and honesty within me as man can weel mak' his bread with, and am willing to aid any distressed creature that is my friend's friend."

So, again, in the deep feeling which rebukes his master's careless ruin of the poor apprentice:—

"I say, then, as I am a true man, when I saw that pair creature come through the ha' at that ordinary, whilk is accurst (Heaven forgive me for swearing) of God and man, with his teeth set, and his hands clenched, and his bonnet drawn over his brows . . ." He stopped a moment, and looked fixedly in his master's face.

And again in saving the poor lad himself when he takes the street to his last destruction "with burning heart and bloodshot eye":—

classic in the highest degree, and his meaning always the fuller, the further it is traced.

"Why do you stop my way?" he said fiercely.

"Because it is a bad one, Master Jenkin," said Richie. "Nay, never start about it, man; you see you are known. Alack-a-day! that an honest man's son should live to start at hearing himself called by his own name."

"I pray you in good fashion to let me go," said Jenkin. "I am in the humor to be dangerous to myself, or to any one."

"I will abide the risk," said the Scot, "if you will but come with me. You are the very lad in the world whom I most wished to meet." *

"And you," answered Vincent, "or any of your beggarly countrymen, are the last sight I should ever wish to see. You Scots are ever fair and false."

"As to our poverty, friend," replied Richie, "that is as Heaven pleases; but touching our falsity, I'll prove to you that a Scotsman bears as leal and true a heart to his friend as ever beat in an English doublet."

In these and other such passages it will be felt that I have done Richie some injustice in classing him among the religionists who have little sympathy! For all real distress his compassion is instant; but his doctrinal religion becomes immediately to him a cause of failure in charity.

"Yon divine has another air from powerful Master Rollock, and Mess David Black of North Leith, and sic like. Alack-a-day, wha can ken, if it please your lordship, whether sic prayers as the Southrons read out of their auld blethering black mess-book there may not be as powerful to invite fiends as a right red-hot prayer warm from the heart may be powerful to drive them away; even as the evil spirit was driven by the smell of the fish's liver from the bridal chamber of Sara, the daughter of Raguel!"

The scene in which this speech occurs is one of Scott's most finished pieces, showing with supreme art how far the weakness of Richie's superstitious formality is increased by his being at the time partially drunk!

It is on the other hand to be noted to his credit, for an earnest and searching Bible-reader, that he quotes the Apocrypha. Not so gifted Gilfillan:—

"But if your honor wad consider the case of Tobit!—!"

"Tobit!" exclaimed Gilfillan with great heat; "Tobit and his dog baith are altogether heathenish and apocryphal, and none but a prelatist or a papist would draw them into question. I doubt I hae been mista'en in you, friend."

*The reader must observe that in quoting Scott for illustration of particular points I am obliged sometimes to alter the succession and omit much of the context of the pieces I want, for Scott never lets you see his hand, nor get at his points without remembering and comparing far-away pieces carefully. •To collect the evidence of any one phase of character is like pulling up the detached roots of a creeper.

Gilfillan and Fairservice are exactly alike, and both are distinguished from Moniplies in their scornfully exclusive dogmatism, which is indeed the distinctive plague-spot of the lower evangelical sect everywhere, and the worst blight of the narrow natures capable of its zealous profession. In Blattergowl, on the contrary, as his name implies, the doctrinal teaching has become mere Blather, Blatter, or patter—a string of common-places spoken habitually in performance of his clerical function, but with no personal or sectarian interest in them on his part.

"He said fine things on the duty o' resignation to the will of God—that did he;" but his own mind is fixed under ordinary circumstances only on the income and privilege of his position. Scott, however, indicates this without severity as one of the weaknesses of an established church, to the general principle of which, as to all other established and monarchic law, he is wholly submissive, and usually affectionate (see the description of Colonel Mannering's Edinburgh Sunday), so that Blattergowl, out of the pulpit, does not fail in his serious pastoral duty, but gives real comfort by his presence and exhortation in the cottage of the Mucklebackits.

On the other hand, to all kinds of independents and nonconformists (unless of the Roderick Dhu type) Scott is adverse with all his powers; and accordingly Andrew and Gilfillan are much more sternly and scornfully drawn than Blattergowl.

In all the three, however, the reader must not for an instant suspect what is commonly called "hypocrisy." Their religion is no assumed mask or advanced pretense. It is in all a confirmed and intimate faith, mischievous by its error, in proportion to its sincerity (compare "*Ariadne Florentina*," page 75, paragraph 87), and although by his cowardice, petty larceny,* and low cunning Fairservice is absolutely separated into a different class of men from Moniplies, in his fixed religious principle and primary conception of moral conduct he is exactly like him. Thus when, in an agony of terror, he speaks for once to his master with en-

* Note the "wee business of my ain," l. 213.

tire sincerity, one might for a moment think it was a lecture by Moniplies to Nigel.

"O, Maister Frank, a' your uncle's follies and your cousins' fliskies were nothing to this! Drink clean cap-out, like Sir Hildebrand; begin the blessed morning with brandy-taps like Squire Percy; rin wud among the lasses like Squire John; gamble like Richard; win souls to the pope and the deevil, like Rashleigh; rive, rant, break the Sabbath, and do the pope's bidding, like them a' put the gither—but merciful Providence! tak' care o' your young bluid, and gang na near Rob Roy."

I said, one might for a moment think it was a Moniplies lecture to Nigel. But not for two moments, if we indeed can think at all. We could not find a passage more concentrated in expression of Andrew's total character; nor more characteristic of Scott in the calculated precision and deliberate appliance of every word.

Observe, first, Richie's rebuke, quoted above, fastens Nigel's mind instantly on the nobleness of his father. But Andrew's to Frank fastens as instantly on the follies of his uncle and cousins.

Secondly, the sum of Andrew's lesson is, "Do anything that is rascally, if only you save your skin." But Richie's is summed in "The grace of God is better than gold pieces."

Thirdly, Richie takes little note of creeds except when he is drunk, but looks to conduct always; while Andrew clinches his catalogue of wrong with "doing the pope's bidding" and Sabbath-breaking: these definitions of the unpardonable being the worst absurdity of all Scotch wickedness to this hour—everything being forgiven to people who go to church on Sunday and curse the pope. Scott never loses sight of this marvelous plague-spot of Presbyterian religion, and the last words of Andrew Fairservice are:—

"The villain Laurie, to betray an auld friend that sang aff the same psalm-book wi' him every Sabbath for twenty years."

And the tragedy of these last words of his, and of his expulsion from his former happy home—"a jargonelle pear-tree at one end of the cottage, a rivulet and flower-plot of a rood in extent in front, a kitchen-garden behind, and a paddock for a cow" (viii. 6, of the 1830 edition)—can only be understood by the read-

ing of the chapter he quotes on that last Sabbath evening he passes in it—the 5th of Nehemiah.

For—and I must again and again point out this to the modern reader, who, living in a world of affectation, suspects “hypocrisy” in every creature he sees—the very plague of this lower evangelical piety is that it is not hypocrisy; that Andrew and Laurie do both expect to get the grace of God by singing psalms on Sunday, whatever rascality they practice during the week. In the modern popular drama of “School”* the only religious figure is a dirty and malicious usher who appears first reading Hervey’s “Meditations,” and throws away the book as soon as he is out of sight of the company. But when Andrew is found by Frank “perched up like a statue by a range of beehives in an attitude of devout contemplation, with one eye watching the motions of the little irritable citizens, and the other fixed on a book of devotion,” you will please observe, suspicious reader, that the devout gardener has no expectation whatever of Frank’s approach, nor has he any design upon him, nor is he reading or attitudinizing for effect of any kind on any person. He is following his own ordinary customs, and his book of devotion has been already so well used that “much attrition had deprived it of its corners, and worn it into an oval shape;” its attractiveness to Andrew being twofold—the first, that it contains doctrine to his mind; the second, that such sound doctrine is set forth under figures properly belonging to his craft. “I was e’en taking a spell o’ worthy Mess John Quackleben’s ‘Flower of a Sweet Savor sown on the Middenstead of this World’” (note in passing Scott’s easy, instant, exquisite invention of the name of author and title of book); and it is a question of very curious interest how far these sweet “spells” in Quackleben, and the like religious exercises of a nature compatible with worldly busi-

* His “hero” is a tall youth with handsome calves to his legs, who shoots a bull with a fowling-piece, eats a large lunch, thinks it witty to call Othello a “nigger,” and, having nothing to live on, and being capable of doing nothing for his living, establishes himself in lunches and cigars forever by marrying a girl with a fortune. The heroine is an amiable governess, who, for the general encouragement of virtue in overcastes, is rewarded by marrying a lord.

ness (compare Luckie Macleary, "with eyes employed on Boston's 'Crook in the Lot,' while her ideas were engaged in summing up the reckoning"—"Waverley," i. 112). do indeed modify in Scotland the national character for the better or the worse; or, not materially altering, do at least solemnize and confirm it in what good it may be capable of. My own Scottish nurse described in *Fors Clavigera* for April, 1873, page 13, would, I doubt not, have been as faithful and affectionate without her little library of Puritan theology; nor were her minor faults, so far as I could see, abated by its exhortations; but I cannot but believe that her uncomplaining endurance of most painful disease, and steadiness of temper under not unfrequent misapprehension by those whom she best loved and served, were in great degree aided by so much of Christian faith and hope as she had succeeded in obtaining, with little talk about it.

I knew, however, in my earlier days a right old Covenanter in my Scottish aunt's house, of whom, with Mause Hedrigg and David Deans, I may be able perhaps to speak further in my next paper. But I can only now write carefully of what bears on my immediate work: and must ask the reader's indulgence for the hasty throwing together of materials intended, before my illness last spring, to have been far more thoroughly handled. The friends who are fearful for my reputation as an "écrivain" will perhaps kindly recollect that a sentence of "Modern Painters" was often written four or five times over in my own hand, and tried in every word for perhaps an hour—perhaps a forenoon—before it was passed for the printer. I rarely now fix my mind on a sentence, or a thought, for five minutes in the quiet of morning, but a telegram comes announcing that somebody or other will do themselves the pleasure of calling at eleven o'clock, and that there's two shillings to pay.

JOHN RUSKIN, in *The Nineteenth Century*.

EARTHQUAKES—THEIR CAUSE AND ORIGIN.*

The most famous earthquake in ancient history owes its celebrity to the strange fact that its shock passed unobserved by the combatants amidst the excitement of the battle by the Thrasimene Lake. And yet it was no slight commotion. Livy tells us, with his usual amplitude of detail, how it overthrew cities, turned rivers backward in their course, and tore down the very mountains; while poetry has given to it an immortal stamp in the lines of Byron—

And such the frenzy, whose convulsion blinds
To all, save carnage, that, beneath the fray,
An earthquake reeled unheededly away.

It does not appear certain, however, that mankind, even in their quieter moments, and when not engaged in the absorbing occupation of cutting one another's throats,† are disposed to give much consideration to one of the most mysterious phenomena in nature. Yet the subject is continually brought to our notice by the accounts of such events in the newspapers. We are authoritatively told that, on an average, two earthquakes occur every day in the year in some part or other of the globe, and those of the severer kind entail a loss of life equal to that caused by a hard-fought battle. Three such calamities as those at Agram, Ischia, and Chios, rapidly following one another

* 1. Studien über Erdbeben. Von Dr. J. F. Julius Schmidt, Director der Sternwarte zu Athen. 2te Ausgabe. Leipzig, 1879.

2. Die Erdbeben u. deren Beobachtungen—Auf Veranlassung der Erdbeben-Commission der Schweiz. Naturforsch. Gesellschaft, verfasst von Prof. Alb. Heim. Zürich—Basel. 1880.

3. The Great Neapolitan Earthquake of 1857. The First Principles of Observational Seismology. Report to the Royal Society. By Robert Mallet, C.E., F.R.S. 2 vols. 1862.

4. Scepticism in Geology and the Reasons for it. By Verifier. 2d Edition. 1878.

† Dr. Julius Schmidt complains of the apathy with which the Phocian earthquake of 1870 was regarded by the Greeks themselves, owing to the absorbing interest of the war between France and Germany, which broke out a few days before, and filled the columns of the newspapers, to the exclusion of home news.

within the short space of six months, have startled the public, and aroused so much sympathy as well as interest as to give us a favorable opportunity for taking up the subject.

Among the works the titles of which are to be found in the footnotes, that of Mr. Mallet claims attention from the fact of his having been sent out by the Royal Society of London, on account of his high mathematical acquirements and engineering skill, immediately after the great Neapolitan earthquake of 1857, to explore that great battle-field of earthquakes, South Italy and Calabria. We are obliged to confess our conviction that the number of new facts brought forward by him bears but a slight proportion to the ponderosity and verbosity of his two volumes, which seem to us especially deficient in order and arrangement. To Dr. Julius Schmidt's valuable volume we propose to call attention farther on.

The recent creation in Switzerland of a "Society for the Investigation of Earthquakes," though we have not as yet profited much by their researches, seems also to show an awakening interest in the question, and we enter on it at present, not with the intention of repeating old stories, but rather of bringing new facts to bear on the nature of these phenomena, and, by thus contributing some additions to what was known before, we hope to throw light upon their causes, sources, and origin, so that we may, as far as is permitted, "assist at the young earthquake's birth," to use the words of the poet. The subject acquires importance from the prominence given by the modern school of geologists to the earthquake, as a cause permanently affecting and modifying the present surface of the earth, and consequently the future destiny of the globe. Lyell goes so far as to assert that * "its actual configuration is due to a continued series of moderate shocks," and that "subterranean movements constitute an essential part of that mechanism by which the integrity of the habitable surface is preserved and the very existence and perpetuation of dry land is secured." If this be true, if even there be the slightest foundation for the assertion, what

* Lyell's "Principles, ii. p. 144.

is the position of the inhabitants of Great Britain, hitherto, as we have flattered ourselves, by good fortune exempt from the miseries caused by such a scourge, or, as geologists would persuade us, shut out from the "eminently beneficial effects" of these visitations?

Making allowance for exaggeration in the narratives of terror-stricken eye-witnesses, the most certain characters and accompaniments of earthquakes appear to be, first, their suddenness, coming without warning of any kind, unless it be the stifling heat and electric state of the atmosphere,—a fact to which less attention seems to have been paid than it merits,—and next, the sullen roar as of distant artillery, or rumble as of heavy vehicles in motion, which accompanies rather than precedes the shock. Most remarkable of all is the rapidity with which it comes, like a shot or a succession of shots, and the irresistible force with which it acts. Human beings cannot stand under it, but stagger and often throw themselves on the ground to avoid being upset. The movement has the effect of a wrench, and persons asleep are thrown out of bed by the concussion. Not single buildings only, but towns and cities go down at once before it, houses are prostrated like a pack of cards, and whole streets fall in rows like the math under the scythe. In Calabria, in 1783, two minutes sufficed to prostrate in ruins every town and village from the west flank of the Apennines to the Straits of Messina, with fearful destruction of life. At Lisbon, in 1755, the subterranean thunder and the shock came, without any warning, and in about six minutes at least 30,000 persons had perished—some accounts give 60,000—the largest loss of human life in so short a time and in so limited a space of which we have any record.

Distinctions have been made between different kinds of shocks, and Mr. Mallet, who, according to the title of his work may be styled a professor of "observational seismology," displays much ingenuity in interrogating shattered houses and fissured walls to ascertain at what angle the blow struck them, what was its rate of velocity, and whence it came, generally with unsatisfactory results, though in one instance he determined the direction of a wave-path "from the

mean of nine sets of fissures" to his own satisfaction. If it were possible to prove that the shock travels in certain fixed directions, especially from east to west, this might lead to important conclusions. As it is, we are sure only on one point, that it comes from below. Mr. Mallet's labors in South Italy to clear up the quarter whence the earthquake came and whither it went generally left him, as he naively tells us, "at sea." It is not an unusual thing to be able to perceive the earthquake approaching through the undulatory movement of the surface, as if the earth were shaken like a carpet, or as the waving of corn swept by a breeze. This is seen in the country by the bending of trees and woods, switching their branches backward and forward so as to touch the ground; in towns by the pavement of the street rising and falling in billowy undulations; and it is perhaps caused merely by the vertical blow or upshot extending itself horizontally, and seeking where to escape, as we shall try to explain presently. The "vibratory movement," constantly mentioned as following the shock, is also probably the result of a severe concussion gradually subsiding.

The power of the direct impulse from below is proved by some telling incidents. Not unfrequently the masonry of buildings has been shattered, and stones have been driven out of a wall and scattered; Mallet even records an instance of the top of a massive tower of the Dominican convent at Montemurro being shorn off (?) by a blow from beneath, aimed at an acute angle, and leaving the stump standing.* Humboldt mentions a case in which bodies in a cemetery were hurled upward out of their graves; and in more than one instance paving-stones have been jerked up out of their places and turned over in the air, descending with their upper sides below.† The number of shocks, the length of the pauses between them, and the duration of earthquakes vary infinitely. That of 1855, at Visp, in the Valais, continued for months, gradually becoming less violent, but did

* Mallet (vol. ii. p. 2) does not vouch for this as a positive fact, but he was told so on the spot.

† Lyell's "Principles," vol. ii. p. 120.

not die out altogether until 1857. That in the Sandwich Islands, in 1868, lasted several months, and in one month alone two thousand shocks were counted, while in Greece the commotion has been known to endure for years.

The range of earthquakes spreads over a large part of the globe, few large spaces entirely escaping at one time or other, but it is most restricted in the temperate regions, attaining the greatest intensity in the tropical zones, or where great heat prevails, as along the west coast of South America, throughout the West Indies, and along a belt stretching from the Azores to Asia Minor, crossing Spain (along the Pyrenees), Italy, and Greece; in the Malay Archipelago, Java, and Sumatra. Where volcanoes exist they seem to have an intimate connection with earthquakes, and even sometimes the sudden outbursts of volcanic force may act as safety-valves to arrest or divert them. Yet the center of earthquake action by no means coincides with the volcanic center, and regions remote from any volcanoes, as the Himalayas, India in general, North Africa, Syria, and the Mississippi valley, are constantly subject to subterranean commotions. Earthquakes seem to occur most frequently on the borders of the sea, in plains, near river-courses, and at the bottom of deep valleys; and these spots will, in many cases, be found to coincide with the lines of great natural faults in the earth's crust, leaving open some gap of communication with the inner world below. Comrie in Perthshire, the place in Scotland most favored with shocks (harmless ones, it is true), has been shown by Professor Geikie to stand on the line of such a fault; and the great Glen of Scotland, also similarly visited at times, is another. They adhere to spots where hot or mineral springs, discharges of gas, mud volcanoes, and geysers burst forth.

As a rule—not without exceptions, perhaps—their greatest power and most destructive effects are exercised upon the more recent, superficial, and incoherent formations—clays, tertiary marls, and the like; so that buildings upon alluvial plains, river deltas, and so forth, are more thoroughly shattered than those on rock or solid strata. The Calabrian convulsion had its full

swing upon deep marls, clays, and sand-beds of slight consistency; that of Ischia was upon deep clays. Independent of the site, the power of resistance in buildings depends, of course, on the strength, goodness, and massiveness of the masonry to resist overthrow. The Quay at Lisbon, which was swallowed up, together with thousands who had sought refuge upon it, in a chasm that opened in the bed of the Tagus, leaving no trace behind, was built upon alluvial soil, while the upper parts of the town, standing upon basalt and limestone, remained uninjured."*

It appears probable that the shocks may be either deadened or deflected and turned aside, when they impinge upon a mountain mass. On the other hand, the effect produced upon mountains by the concussion is confined to shaking down loose earth and stones and detached rocks from their steep slopes, often causing land-slips so extensive that, in the language of the affrighted Calabrians, "one mountain came down to meet another." These downfalls of earth dam up the river-courses, causing overflows, ponds, and morasses. In this way also gaps and scars are sometimes formed at the junction of different strata, the upper slipping down over the lower. Of this nature probably was the great fault of a gap said to be 90 miles long, dwelt upon by Lyell in his account of the New Zealand earthquake.

Cracks and fissures in the ground are commonly made by these convulsions, but these also are generally confined to superficial strata, soft disintegrated deposits, clays, and similar formations. There are few authentic instances of their penetrating into the solid rock beneath,† though both Mallet and Schmidt advance one or two cases. In an earthquake at Mendoza‡ there was no trace of fissure when the firm rock came to the surface. The ordinary chasms, on alluvial and soft ground, have been known to open and close, sometimes swallowing up human beings and ejecting them again. Crater-shaped cones are

* Lyell's "Principles," vol. ii. pp. 82-83.

† Mallet's "Report," vol. i. pp. 324, 405; vol. ii. p. 366.

‡ David Forbes, in *Journal of the Geological Society*, August 1872.

formed along the line of these cracks, and jets of water and mud are spouted from these as well as from the cracks, as was the case near Agram in 1880. In the Ava earthquake, 1839, deluges of water burst forth from such fissures 10 to 20 feet wide, emitting a smell of sulphur.* On that occasion, too, the rapid stream of the Irrawaddy was arrested and even reversed in its course for a while by the shock.

It is worthy of note that down in the depths of mines the tremor felt on the surface is either very much diminished or passes unnoticed; nor is it perceived in shafts of wells or in tunnels; in fact, all the evidence goes to prove its very slight influence upon the solid framework of the globe.

The area over which the commotion of an earthquake extends varies according to the violence of the shocks; that of Lisbon, according to Humboldt, was felt over a region four times the size of Europe, while at Linth-thal, in canton Glarus (March, 1879), a shock which threw sleepers out of their beds stopped short a few miles to the west on reaching the Reuss, and did not extend so far as Glarus.† Sometimes mountains, at other times valleys, seem to arrest the shock and to oppose its spreading, while instances exist of its ramifying through almost all the valleys of the Alpine chain. So likewise in the region of the Andes, in November, 1827, every place was destroyed between Bogotá and Popayan, a distance of nearly 700 miles.

While preparing this article, we have been favored by a friend with the loan of a MS. narrative of the Lisbon earthquake, by an Englishman, Mr. Chase, who went through the whole of it as a witness and sufferer. It is in the form of a letter to his mother; and as it appears never to have been published, we avail ourselves of the permission to make a few extracts from it.

About three quarters after nine o'clock on the morning of Saturday, the day that made me twenty-six years of age, in the very house I was born, on the 1st of November, 1755, I was alone in my bed-chamber, four stories from the ground, opening a bureau, when a shaking or trembling of the earth, which I knew immediately to be an earthquake, gentle at first, but gradually increasing to greater violence,

* Newbold's "Malaccas," vol. I. Appendix.

† Prof. Heim, "Die Erdbeben," p. 9.

alarmed me so much, that turning round to look at the window the glass seemed to be falling out. Surprised at the continuation of it, and immediately recollecting the miserable fate of Callao in the Spanish West Indies, I expected the same would happen then; and also remembering that our house was old and weak, that any heavy carriage passing made it shake all over, I ran directly up into the urado. This place, as is customary in many houses, was a single room at the top of the house, with windows all round the roof, supported by stone pillars; it was only one story higher than my chamber, and commanded a prospect of some part of the city from the king's palace up to the castle. I was anxious to see if the neighboring houses were agitated with the same violence. I was no sooner up the stairs than the most horrid prospect that imagination can form appeared before my eyes. The house began to heave to that degree, that to prevent my being thrown down I was obliged to put my arm out of a window to support myself by the wall; every stone in the walls separating each from the other, and grinding against each other, made, as did all the walls of the other houses with variety of different motions, the most dreadful jumbling noise ears ever heard. The adjoining wall of Mr. Goddard's room fell first, then followed all the upper part of his house, and every other after, as I could see toward the castle; when, turning my eyes quick to the front of the room, for I thought the whole city was sinking into the earth, I saw the tops of two of the pillars meet, and saw no more. I was resolved to throw myself upon the floor, but I suppose I did not, for I immediately felt myself falling, and then, how long after I know not, just as if waking from a dream with confused ideas, I found my mouth stuffed full of something that with my left hand I strove to get out, and not being able to breathe freely, struggled, till my head was quite disencumbered from the rubbish. In doing this, I came to myself, and, recollecting what had happened, supposed the earthquake to be over, and, from what I had so lately seen, expected to find the whole city fallen to the ground, and myself on the top of the ruins. When attempting to look about me, I saw four high walls near fifty feet above me. The place where I lay was about ten feet in length and scarce two feet wide, nor could I perceive either door or window in any of them. Astonished to the last degree at my situation, I remembered that there was such a place between the houses. Not having seen the upper parts of both fall, I concluded that either the inhabitants must all be destroyed, or at least no probability of their looking down there again in time enough for my preservation; so that, struck with horror at the shocking thought of being starved to death immersed in that manner, I remained stupefied, till the still falling tiles and rubbish made me seek for shelter under a small arch in the narrow wall, opposite my head; as I lay at the bottom of which, there appeared to be a little hole quite through it. Upon my approach, with difficulty dragging myself out of the rubbish, I found it to be much larger than I imagined it was, and getting in my head and arm first, by degrees pulled my whole body after, and fell about two feet into a small dark place, arched over at the top, which I supposed to be only a support for the two walls; till, feeling about, I found on one side a narrow passage that led me round a place like an oven, into a little room, where stood a Portuguese man, covered with dust. He, the moment he saw me coming in that state, starting back, and crossing himself all over, cried out, as the custom is when much surprised, "Jesus! Mary and Joseph! who are you? Where do you come from?" which being informed, he placed me in a chair. This done, clasping his hands together, he lifted them and his eyes to the ceiling, in show of the utmost distress and concern. This made me examine myself, which before I

had not time to do. My right arm hung down before me motionless like a great dead weight, the shoulder being out and the bone broken; my stockings cut to pieces, and my legs covered with wounds, the right ankle swelled to a prodigious size, with a fountain of blood spouting upward from it, the knee also much bruised. My left side felt as if beat in, that I could hardly breathe; all the left side of my face swelled and the skin beat off, the blood streaming from it, with a great wound above and a small one below the eye, and several bruises on my back and head. Barely had I perceived myself to be in this shocking mangled condition when another shock, more threatening than the first, came on. The poor man flew directly out of the door. The violence of it and the falling of houses, with the screams of the people, made me again seek shelter at the arch I had entered in at; where, waiting till it abated, I returned back again, and, nobody appearing, went out at the same door I saw the man do, in hopes to find him again, or meet with some other person. But instead of a room, as I expected, it was a narrow staircase, with a few steps one way; then, turning, as many more brought me, to my surprise, into the street, not imagining myself to have been so near it. The people were all at prayers, covered with dust, and the light appeared just as if it had been a very dark day. Then, flattering myself that my legs might still support me to the water side, I turned and saw the street below. That was very narrow, filled with fallen houses, as high as the tops of the remaining ones; then, in hopes to get into the country, I advanced a few steps up the hill, till the same sad prospect appeared above, and in a street to the right I saw no other. Not knowing what to do, my strength failed, and I fell prostrate in the middle, just where three streets met.

At such an hour of peril, when every one was considering his own danger and seeking his own safety, Mr. Chase was indebted for his rescue to a neighbor, Mr. John Ernest Forg, a merchant of Hamburg, by whom he was removed, after some hours, to a house which had withstood the shock, put to bed, and his wounds dressed by a surgeon. But he had not lain down long before another shock, "having covered over the bed with plaster falling and dust, made me lay my left arm over my eyes, soon expecting to be released from all further misery." Next the news reached him that the city was on fire in various places. "All that afternoon I had time to make the most melancholy reflections, while the flames were spreading everywhere within my view with inexpressible swiftness, till about five o'clock they seemed approaching the very room wherein I lay." An agony of apprehension then seized him that he had been left alone in the house, and that his friends had quitted it; but having with great difficulty, through his weakness, managed to open the door, he found them seated around the outer room in silence:—

I begged Mr. Forg, with tears in my eyes, as the greatest favor, that before he found himself obliged to quit his house he would either throw me over the gallery, or in any way dispatch me, and not leave me in violent agonies lingering a few hours to die a most miserable death. He desired me not to talk in that manner, and assured me affectionately he never had intended to leave me, and if no other help came, he would carry me himself upon his back; that we would take our chance together; that the fire had not yet surrounded us, and that there was still a passage free.

Under the same friendly guidance he was conducted among falling houses, during shocks constantly repeated, past streets partly blocked up with ruins, partly already on fire, to the open place in front of the palace, whither a vast number of fugitives had already repaired, with what clothes and other property they had been able to save, tied up in bundles.

To find myself then, so much beyond all expectation, so suddenly relieved from the constant apprehension of falling houses and danger of the fire, as I thought at least, when I was in the greatest despair and had given up all hopes of further assistance, raised my spirits to that degree, that now for the first time, notwithstanding the great pain I was in, I began to hope that it was possible still to live, till new terrors employed my thoughts. For the people, all full of the notion that it was the Judgment Day, and willing therefore to be employed in good works, had loaded themselves with crucifixes and saints; and men and women equally the same were, during the intervals between the shocks, either singing litanies or cruelly tormenting the dying with religious ceremonies, and whenever the earth trembled, all on their knees roaring out "misericordia!" in the most dismal voice imaginable. The fear that my condition might excite their piety at such a time, when all government was at an end, and it was impossible to guess what [treatment] a heretic [might receive], made me dread the approach of every person. Add to this, that the Cais de Pedra, or stone key adjoining to this square, had already sunk, and the least rising of the water would overflow us all.

The writer was eventually conveyed to a boat on the river, and thus rescued from the ruined city. He winds up his simple account of these events with an expression of gratitude to Mr. Forg, "with whom I had had a slight acquaintance, who, like a guardian angel, appeared always ready to assist me in the utmost extremities."

Some time afterward I learned that no part of our house fell, except the urado where I was, nor were any of the family killed, only the housekeeper and one manservant were much hurt by the falling of the urado upon them as they were going out of the house. The ceilings of the upper story were, however, so much hurt, they were afraid to venture into any of the rooms. It is universally agreed that all the mischief proceeded from the three first shocks of the earthquake, which were

attended with a rumbling sort of motion like the waves of the sea; that it was amazing the houses resisted so long as they did. No place nor time could have been more unlucky for the miserable people. The city was full of narrow streets; the houses, strong-built and high, that falling, filled up all the passages.

Grecian earthquakes have hitherto obtained less attention than others, probably for want of an historian, but such a one now presents himself in the person of Dr. Julius Schmidt, who has availed himself of his position, as the government astronomer at Athens, to obtain information on the spot, and to record really scientific observations on all the facts that fell within his own knowledge. He has embodied the results in a truly valuable volume, "Studies of Earthquakes," which, besides his own personal experience, contains a very complete chronological table, carefully compiled by him, of all Levantine earthquakes from 1840 to 1878. Our readers may be surprised to learn that this record occupies no less than 200 pages, including the day, hour, place, and character of the shock.

Greece had of old obtained the reputation of being "the easily shaken" country (*εὐσείστος*). The god Poseidon, the earth-shaker, held sway there of old, and it would seem as if his malign influence had prevailed even to the present day, and that it must be due to his trident that the "long-deserted shrine of Delphi" has been desolated, and the sacred spring of Castalia buried out of sight—literally bunged up under a heap of rubbish.* This occurrence was one of the disastrous consequences of the earthquake of 1870, one of the severest to which Greece has been subjected in modern times. It lasted, with more or less severity, for three years, the shocks and detonations continuing day and night with slight interruptions. The province of Phocis, north of the Gulf of Corinth, was the chief theater of its ravages, and Dr. Schmidt places the center and origin of the convulsion beneath that district.

From January to June, 1870, was a comparatively quiet time; only about eighteen shocks—not an unusual number—being recorded in his list. On July 31, however, the earth-storm

* We have recently heard that the spring has been cleared out, but the rock basin which received it is destroyed.

began in earnest, and early in the morning of August 1 occurred the first terrible vertical blow, lasting from fifteen to twenty seconds, in which short time the towns and villages of Itea, Xeropigo, Chryssos, and Delphi, with parts of Arachosia and Amphissa, were entirely destroyed. Nineteen minutes later the earth heaved again, causing rock-slides from Parnassus and Korax, unexampled for quantity, which completed the ruin. Fortunately the intense heat of the weather of the preceding day had induced the greater part of the inhabitants to sleep in the open air, so that the loss of life in all the district did not exceed 100.

On August 5th, four days after the great shock, Dr. Schmidt set forth, at the instigation of the Queen of Greece, on a tour of inspection, to ascertain the extent of the misfortune, and, if possible, to devise measures for the relief of the sufferers.

At 6 o'clock on the morning of August 6th [he says] we set out to ride to Delphi, not far off. The path is a steep ascent, and I dismounted, to be more free to escape rock-falls. Detonations were constantly heard. At 7 I halted close to the site of Lenormant's excavations. Delphi lay before us absolutely prostrated on the ground; single fragments of wall alone standing upright, along with the small church-tower. The convent and church of the Panagia, a little to the east, was also in ruins, the olive-trees around it being interspersed with huge blocks, which had rolled down and had smashed trees centuries old. Rubbish and blocks of stone, olive-trees and poplars, lay in confusion one above the other in the steep gully ending in the Pleistos river.

Close to the fountain of Castalia, west of it, gigantic obelisks of rock, from 300 to 400 feet high and 60 to 80 feet thick, had been detached from the face of the far-famed lofty cliff known as Phædriades, and had fallen across the open field which separates Delphi from the Castalian spring. The spring itself had been partly overwhelmed by rock shaken down from the eastern precipice, and, in order to approach the broken basia which heretofore received its waters, it was necessary to climb over the rubbish.

Dr. Schmidt proceeds:—

Anticipating that the venerable spot would soon be obliterated from human sight, we ventured to approach it, though the continuance of the thunderings and earth-shocks kept us in a state of constant alarm, and we rapidly withdrew, glad to escape further dangers. Delphi lies upon unstable ground, and therefore suffered terribly. Its destruction began early at night and was completed by the shock which occurred about half-past 1 P.M. We found the inhabitants camped out a little to the west of the ruins, without a tree to shade them, but so as to be out of the reach of falling rocks. Under temporary sheds of planks were many sufferers wounded in the ca-

tastrophe, attended by two military surgeons sent from Athens. Twenty-two dead bodies had been buried. Some had remained three days under the ruins before they could be extricated.

The rest of Dr. Schmidt's tour of inspection was performed under the noise of constant thunders and the tremor of incessant shocks.

If we are to credit verbal assurances that in the first three days of the Phocian earthquake a shock occurred every third minute, there must have been at least 86,000 shocks. Counting myself at Itea, four days after the great outbreak, I found that the perceptible shocks and detonations amounted to 1,700 or 2,000 in the twenty-four hours.

Until winter set in the earth enjoyed no complete rest, so that, including the slight tremors readily perceptible in the silence of night, it is evident that for the last five months of 1870 the shocks and detonations must have reached the immense number of 500,000.

The village of Delphi remained long in so utter a state of demolition, and the site is so greatly menaced by rock-slips as well as earth-tremors, that it seems doubtful whether it will be rebuilt.

Although most of these shocks were trifling, and some scarcely perceptible, yet they were interspersed with dangerous concussions, so as to keep up an uninterrupted reign of terror among the inhabitants, who never could feel secure; for, although in the second year the shocks diminished in violence, the rock-falls were numerous, and the subterranean roar as loud as ever. Thus on October 19th, while the inhabitants of Amphissa were all in the open air gazing at a fearful prodigy in the sky, a blood-red aurora, there came "an annihilating blow," which leveled with the dust every edifice still standing in that place, and even shuffled the planks laid to form temporary sheds. On October 25th, at Chryso, the swaying backward and forward of the props of a similar shelter measured more than six feet.

One merit of Dr. Schmidt is that he does not weight his observations with theories, but merely furnishes facts from which others may draw conclusions. One of the results at which he has arrived is that the great earthquakes almost invariably have

a direction from north-east to south-west;* and he illustrates this by the fact observed by the inhabitants of Amphissa, that on the occurrence of shocks they displayed themselves by the loosened rocks falling from Korax on the west, in the first instance, followed by similar shoots from the sides of Parnassus on the east, after an interval. It is somewhat remarkable that upon that same October 19, 1870, occurred the most severe shock observed in the Middle and Eastern States of North America during the present century. The instant the shock was felt at Quebec it was telegraphed to Montreal, and the message reached that place about thirty seconds before the shock arrived. Hear again the course taken by the shock was from north-east to south-west. Is not this the line of path habitually followed by electric currents?

Want of space prevents our entering into details of a previous earthquake of December 26, 1861, in Achæa of which our author was also an eye-witness, except to refer to his description of the very remarkable fissuring of the earth caused by it. Through the low alluvial Achæan plain or delta five small rivers, which by their deposits have created it, find their way into the Gulf of Corinth. The effect of the shocks upon this plain of sand, mud, and clay, and of three or four great sea-waves which followed them and rushed a considerable distance inland, was to cause the loose soil to be starred and split by a sort of network (*étoilement*) of thousands of cracks and fissures for a distance of nearly eight miles, with a width varying from 20 to 200 meters, and from 5 to 10 feet deep. This remarkable appearance was doubtless due to the loosening of the earth by the shock, aided by the washing of the sea-waves, their combined action causing the upper stratum to slide over the lower. At the same time a margin of the shore, varying from 20 to 200 meters in width, was in one or two places swept off into the sea. One consequence of the uneven pressure thus caused was the formation of hundreds of circular sand-craters along the line of the splittings, through which were discharged jets of water, mud,

* Schmidt, "Studien," p. 120.

and sand, according as the unequal pressure acted upon the soft soil below. The theater of these commotions was within a very short distance of the site of that ancient port of Helice which Diodorus tells us was swallowed up by an earthquake, along with its houses, inhabitants, and even ten ships in its harbor. in the dead of night, so that when morning dawned not a vestige was visible, but the sea flowed over the site of the grove of Poseidon, the Earth-shaker, to whose wrath the calamity was attributed.

So far we have traced the effects of earthquakes upon land; let us now observe what are their consequences upon the sea. The most remarkable of these are the enormous waves which ensue, sometimes within a few minutes, sometimes after an interval of many hours after a shock. At such times the sea, rising to a height of 50 or 60 feet, rushes inland with power irresistible, sweeping along with it seaweed, shells, and shingle, which it deposits at various heights and distances. Vessels are torn from their anchors and transported a mile or more inland, over intervening obstacles, so as to leave them high and dry, where they remain, not to be returned to their natural element. These fearful waves are among the chief instruments of destruction to sea-port towns, as at Lisbon in 1755, and at Lima (Arica) in 1724, which was utterly destroyed by such a wave, and every soul drowned. They are propagated not only along the coast for hundreds of miles, but even across the broad ocean, which seems to oscillate from side to side, like the water in a full basin which has received a sudden blow or jar. They follow one after another, backward and forward, alternately deserting the shore and sweeping beyond it, "spilling the ocean o'er its boundary." The earthquake in Peru (August 13, 1868) made itself felt in Hawaii the same evening, 6,300 miles off, by the huge billows which came rolling in at the rate of three or four per hour, and continued after an interval for four days. In about the same time the wave had made its way north to San Pedro Bay in South California.

One very remarkable phenomenon connected with earthquakes is the way in which ships out at sea, in the midst of compara-

tive calm and in deep water, are affected by them. It appears from numberless instances* that they receive a sudden concussion from below, so violent as to strain the timbers and snap ropes and masts, giving to those on board the impression of striking upon a rock, or, as a naval friend tells us, of the chain cable running out rapidly through the hawse-hole. An earthquake occurred while the English and Turkish fleets were anchored off Ismid in 1878. A lady, seated in the cabin of one of the British ships, was aroused by a crash which made her think the vessel had been run into. The Turkish crews were seen rushing to quarters, supposing Russian torpedoes to have exploded under their keels; but no sooner did our informant reach the shore than the toppling minarets revealed the source of the surprise. Lyell enumerates many instances of concussions felt out at sea.

Looking to this, then, as a usual consequence of earthquakes, it seems to us to afford a hitherto unsuspected clew to their origin. Considering the irresistible force, the unmeasured rapidity, the quick repetition and long duration of the shocks, what known agent in Nature, we would ask, except electricity, is capable of producing at the same time such singular effects in the sea and such tremendous results on land? We will endeavor to strengthen our conjecture by a few more facts in evidence. Lyell† and other authors have mentioned, without laying upon the occurrence the stress it deserves, the state of the atmosphere before an earthquake as densely charged with electricity,‡ and they even speak of evolutions of electric matter or inflammable gas. Mr. Mallet§ was repeatedly told by various witnesses in different parts of Campania that on the night before the shocks they had seen an unusual light in the air or sky. Some asserted that a halo came out of the ground just before the shock; the same belief prevailed at Val Viggiano and at Auletta. Mr. Mal-

* Lyell's "Principles," vol. ii. p. 149.

† Ibid., p. 82.

‡ Before the earthquake in October, 1875, at Martinique, M. Rivet, telegraph inspector, found a very marked disturbance in the electric telegraph.—*Comptes Rendus*, lxxxi., October, 1875.

§ Mallet's "Reports," vol. i. pp. 322, 323.

let observes : * " It is difficult to see any direct traceable connection between it and the earthquake." But we know well that lightnings constantly flash among the smoke and vapor issuing from eruptions of Vesuvius and other volcanoes. The vicinity of hot springs, volcanoes, mud lakes, regions of intense heat, and centers of the electric influence, are the special haunts of the earthquake, and science has pretty well proved that heat and electricity are convertible. To what other cause, also, but lightning can we so fitly attribute the accompanying, long-continued underground thunder and the conflagrations † which constantly ensue among the prostrate ruins of towns visited by these catastrophes, as at Lisbon in 1755 ?

These and other circumstances inseparably connected with earthquakes all point to the conclusion that an earthquake is the result of discharges of terrestrial electricity accumulated in the bowels of the earth, which we know to be a reservoir of electric matter, whose extent and capacity we may in future be enabled to measure by the number and duration of earth-con-vulsions.

Even if it be proved that the solid strata beneath the surface, and the mountain masses above it, are unfavorable to the transmission of electric energy, there are plenty of cracks and fissures in its solid substance through which the electric force may penetrate and shoot forth. In the waters of ocean it finds a ready conductor, which accounts for the way in which ships on the sea are affected by it ; but when it approaches the earth's surface it encounters the resistance of deep, partially incoherent beds of clay, gravel, alluviums, late tertiaries, and the like, forming the most perfect non-conductor which can be conceived, with difficulty movable by the force exercised upon it, yet not doggedly resisting like the mountain masses. This earthy cushion not only arrests the progress of the electricity, but compels it to force its way out, if not vertically, horizontally, whenever it reaches a thin or weak layer, where it can most easily break through and escape.

* Mallet, vol. ii. p. 375.

† Lyell's " Principles," vol. ii. p. 140.

This struggle will account for the undulatory movement, so constantly following a shock, which has caused the whole phenomena to be attributed to "a wave of transmission," or "translation," "an earth-wave returning at intervals to a certain favorite spot;" whereas it is quite certain that the shock is a direct blow, not differing probably from that of a lightning-stroke. The "earth-storm" resembles the atmospheric storm, except that the one comes from below, the other from the clouds above. The object struck in both cases is shattered to pieces by an irresistible blow; the shock and the flashes follow, shot upon shot, with varying rapidity; and, as the storm dies away, end in vibrations—in one case of the sky lasting for hours, in the other in tremblings of the ground, which may endure for months.

Mrs. Somerville* mentions a case of a storm near Manchester, in June, 1835, when "the lightning was observed to issue from various points of a road, attended by explosions as if pistols had been fired out of the ground, and a man seems to have been killed by one of these explosions taking place under his feet." Very worthy of note is A. von Humboldt's description of the accompaniments of the earthquake at Cumana, at which he was present, March 26, 1812. For six days previous a reddish vapor had covered the whole azure vault of heaven:—

The atmosphere appeared on fire. Clouds gathered over the mountains on the sixth day; and amidst a storm of lightning, at the moment of the strongest electric explosion, there were two shocks of an earthquake. Some slaves drawing water from a well, more than twenty feet deep, heard a report like the explosion of a strong charge of gunpowder. It seemed to come from the bottom of the well.†

In narratives of earthquakes we read of the shattering of masonry, of stones scattered to a distance, and of the top of a heavy tower shorn off, results clearly not due to a mere shaking of the ground, but to blows delivered from below, vertically or at a high angle. If we imagine lightning-strokes multiplied in number and magnified in intensity attacking the lower walls and foundations of buildings, instead of the towers and chimneys, we have a force capable of effecting the complete over-

* Somerville, "Connection of the Physical Sciences," p. 305.

† Travels, vol. ii. p. 512.

throw of a city. Observe, we do not attribute such catastrophes exclusively to direct blows, nor do we doubt that the uplifting of the ground, caused by the electric force seeking to escape, effects great part of the injuries. The progress under ground of the electric jet may be traced, where there are no buildings, by its power to rip up the surface, and we venture to suggest this as the cause of those cracks and chasms opened in the soil, such as were observed near Agram, 1880, in some instances extending for two or three miles.*

We offer this hypothesis to the investigation and scrutiny of our readers, and of scientific men in general, believing that it is as worthy of consideration as the many existing theories, that earthquakes are produced by such causes as the following: either by water expanding into steam† on coming into contact with subterranean lava; or by chemical changes or combinations within the earth; or from the shrinking and cooling down of the earth's crust; or from rupture by tension;‡ or by collision between solids and a liquid. Mr. Mallet, in his "Dynamics of Earthquakes," explains the phenomenon to be the passage of a wave of elastic compression, causing each particle of earth to perform a vibratory movement—an idea based upon the supposed analogy of aqueous waves. Another authority regards it as "an uncompleted effort to establish a volcano"!

We especially invite the attention of that learned body, the telegraphic engineers, who have made such progress in studying the electric currents of the earth and their line or order of circulation around it, to consider whether it may not be possible to invent some species of conductor capable of averting the calamity from its habitual haunts? We would gladly ask of medical men who have attended upon the victims of earthquake whether there be no cases among the deaths showing traces of lightning scars upon the bodies, and not merely of contusions from falling buildings?

* See *Nature*, April 7, 1881.

† "The agency is certainly steam."—J. PHILLIPS.

‡ Most of these attempted explanations are enumerated by Professor Phillips, in his volume on "Vesuvius."

A sketch of the natural history of earthquakes, however, can by no means be regarded as complete without a careful examination of their alleged permanent influences, especially of their power to lift up a whole mountain chain, or the bottom of the sea—assumptions not only adopted but reasoned upon in books of elementary geology.* If the theory we have just propounded should be accepted, it of course settles the question; but, in the present state of geological opinion, we wish to test the now prevalent hypothesis of Modern Causes upon its own merits, by passing in review the chief instances brought forward by Lyell, in his "*Principles of Geology*,"† of so-called permanent elevation.

Since the first publication of his popular work, great additions have been made to our stores of information about subterranean movements. We have before us the elaborate memoir on the Theory of Earthquakes and of Elevation, by the late Professor Hopkins‡ of Cambridge, who sums up with the conclusion that earthquake shocks, even the greatest, raise neither continents nor islands. Through very small spaces the earth is lifted by them and let fall again, the momentary elevation comes to an end, and we have no warrant for believing that any sensible or permanent change of the relative level of sea and land can be produced by such mechanism. Mr. Robert Mallet visited one prostrate town after another in South Italy and Calabria immediately after the destructive catastrophe of 1857, describing the nature and extent of the calamity in each; but, after traversing 150 miles of sea-coast and river-courses, "he could find no trace of permanent elevation." One district which he visited, the Plain of Diano, furnished the most delicate of all tests, because, being cultivated under a system of irrigation, the slightest derangement of the levels of the water-courses would have been instantly perceptible.§ Of these he found not the least trace. He winds up with this conclusion: "Experience and facts dis-

* See Lyell's "*Principles of Geology*," vol. ii. pp. 82, 94, 135, 162.

† Vol. ii, *passim*.

‡ Repor. of the British Association, 1847.

§ Mallet, vol. ii. p. 33.

prove the assumption very commonly made and constantly repeated, without any attempt to apply measures to the test of the doctrine—that earthquakes are direct agents of elevation of the surface of our globe.”*

Against this is to be set the long array of stories of earthquakes produced by Lyell, all told in a way to favor his own conclusions; yet throughout with the most perfect fairness, in so much so as to induce us to think we shall be able to show that his own admissions, in most cases, invalidate or destroy his premises. Indeed, it would not be possible to conduct the case against him on a more unbiased method than that of adopting as far as possible his own words.

In regard to the Campanian earthquake, the author of the little volume “Skepticism in Geology,” to which we shall have occasion to refer again, gives the following very necessary warning to the readers of the “Principles”—

But the reader of Lyell, who has admired the curious wood-cuts of straight and starred fissures, holes, ravines, and chasms, must not for a moment suppose that these were formed in solid rock, that they lasted any time, or that any one visiting the spot would be likely to find any trace of them at the present day. All the fissures gradually closed up, for they were confined to superficial deposits, alluvium, clay, gravel, and an incoherent tertiary sandstone, according to Dolomieu (Brit. Assoc. Rep., p. 39). This is also acknowledged by Lyell, who adds that “in more solid rocks we may expect that fissures will remain open for ages.” Yet he is able to adduce no example of such permanent fissures in Calabria, nor of any enduring change of level.

Concerning any alterations of the surface produced by a former Calabrian earthquake of 1783, Lyell admits that “none of the accounts establish that they were on a considerable scale.”† Great stress, however, is laid upon an asserted change of level of at least 20 feet in the Bay of Naples since the Christian era, on the evidence of the condition of the so-called Temple of Serapis, three marble columns of which still stand on the shore or in the water of the bay, a spot more than any other in Europe subject to volcanic commotions. This building, the puzzle of the antiquary and geologist, and the plaything alike of earth-

* Mallet, vol. ii. p. 321.

† “Principles,” vol. ii. p. 120.

quakes and of volcanic action for centuries, its pillars bored by the teredo for a height of 6 feet, is now supposed to have been no temple, but a grand public bath. In the teeth of Lyell's assertion that "it could not have been built originally under water, and must therefore have first sunk down 20 feet," recent researches render it highly probable that it was founded in the sea itself in order to inclose a hot spring rising in the sea amid the waves, which along with the sea-water was conducted into baths sunk below the surface. At all events it can upon no pretense be correctly cited as an example of permanent elevation of the sea-level or depression of the coast, for the three columns, after all their ups and downs, now stand nearly on the same level that they did 1600 years ago.* In 1852 the floor of the temple was on a line with the sea, and Lyell was informed "that the downward movement had ceased."† Mallet ascertained that the earthquake of 1857 had caused no change in this spot.

The Fort of Sindree, on the east bank of the Indus, Lyell tells us, was in 1819 partly submerged by an earthquake‡ and surrounded by water; while a long mound, the Ullah Bund, was lifted above the waters. "In 1838," says a traveler who visited this spot, the "lagoon has diminished both in area and depth, and part near the fort was dry land."§ In 1869 Mr. Wynne|| "found the area of water and marsh nearly filled up, and but a small shallow pool remained about the fort itself." He doubts the supposed elevation of the neighboring mound called the Ullah Bund, and conjectures that the temporary depression of the ground round the fort gave rise to the story.

The Chilian earthquake of 1822, very fully described in the "Principles," derives importance from the extraordinary conclusion which the author draws from it in support of his theory of the power of earthquakes. In one of his early chapters occurs

* When it is known that the height of the tide round the base of the columns varies from 18 inches to 2 feet, according to the influence of wind, one source of error in estimating the position of this building is made apparent.

† "Principles," vol. ii. p. 175.

‡ Ibid., p. 100.

§ Ibid., p. 102.

|| Quoted by Mr. Blanford in his "Geology of India," p. 421.

the following sentence (vol. i. p. 130): "It may be well briefly to state in this place that in Chili in 1822 the volcanic force has overcome the resistance and has permanently uplifted a country of such vast extent, that the weight and volume of the Andes must be insignificant in comparison," and he refers his readers to vol. ii. for explanatory details. Turning to that volume, at pp. 94, 95, and 96, we find it asserted that this earthquake of November 19, 1822, said to have been felt along the coast for a distance of 1200 miles, according to the evidence of certain eye-witnesses raised the land about Valparaiso 3 feet, and at Quintero 4 feet.

We feel bound to point out that these observations as to the land lifted up applied only to a limited space, and that another trustworthy witness, living on the spot (Mr. Cuming, the well-known conchologist), could detect no sign of a rise in the land or sea-bed. He remarked that the tides reached the same level after as before the shocks. At all events, whether this rise was permanent or not does not appear, nor is there a record of any scientific measurements or observations having been made in recent times to ascertain this.

Next we are told that by or after the shock "the water-course of a mill about a mile from the sea gained a fall of 14 inches in little more than 100 yards."*

From this fact it is inferred that the rise in some parts of the inland country was far more considerable than on the borders of the ocean.†

This is a mere inference.

Some observers supposed that the whole country from the foot of the Andes to a great distance under the sea was upraised.‡

This is a supposition.

It is also conjectured by the same eye-witnesses to the convulsion that the area over which this permanent [?] alteration of level extended may have been equal to 100,000 square miles.§

This again is a conjecture, the only ground for which, in Lyell's own estimation, was "the fall in certain water-courses"—

* Lyell, "Principles," vol. ii. p. 95. † Ibid., p. 96. ‡ Ibid. § Ibid.

and he himself dismisses it "as very hypothetical."* He nevertheless thinks it "may be useful to reflect on the enormous amount of change" which this single convulsion occasioned *if* the extent of country moved upward really amounted to 100,000 square miles.†

After carefully analyzing this remarkable passage we believe we have fairly stated the facts, as well as the process by which the author arrived at the astounding conclusion which we have cited above.

We would submit, therefore, this is no evidence either that the rise of ground caused by the earthquake was permanent, or that it extended in an increasing ratio inland to the foot of the Andes, or at all under the sea, much less that a country equal to half the area of France was elevated; and these inferences are more especially confirmed when, recurring to Lyell, we find that

An opinion has often been promulgated of late years that there is a tendency in the Chilian coast after each upheaval to return toward its ancient position.‡

Mr. Darwin, who was in Chili at the time of the earthquake of 1835, appears, to quote again the words of the author of "Skepticism in Geology," "to have been so blinded" by his bias toward "the permanent elevation theory" as not to be able to trust the evidence of his own eyes. "There can be no doubt," according to Darwin, "that the land round the Bay of Concepcion was upraised two or three feet, but it deserves notice that, owing to the waves having obliterated the old lines of tidal action on the sloping sand, I could discover no evidence of this fact, except in the united testimony of the inhabitants that one little rocky shoal, now exposed, was formerly covered with water."§

The demands of exact science are surely not complied with by substituting conjectures, inference, supposition, for stern irrefragable facts, nor will these be accepted as a proper basis for a cosmical theory of the earth, which that of causes now in action pretends to be.

* Lyell, "Principles," vol. ii. p. 96.

† Ibid.

‡ Ibid., p. 156.

§ "Naturalist's Journal," p. 310.

The narrative of the New Zealand earthquake of 1855 closes thus:—

A question arose whether the land about Port Nicholson, upheaved in January "several feet, had not sunk again to some slight extent before September, 1855."*

It would be waste of time to dissect the accounts of the Jamaican, New Madrid, and other supposed upheavals, more especially since this has been done in considerable detail by the author of "Skepticism in Geology" (pages 27, 29, 32).

Have we not adduced facts enough to prove that the power of earthquakes, or of subterranean and volcanic influence, at the present day upon the permanent condition of the globe, if not a mere vision, is at least not substantiated as a certain truth of science?

It is now some hundred years since Hutton propounded his theory of the earth, to account for all former changes on its surface by the operations of existing agents. Lyell, by his genius and skill as a writer and investigator, gave popularity to these speculations, through the weight of his name as a leader in science, and his merits were nowhere more warmly acknowledged than in *The Quarterly Review* (see Nos. 53, 126). But with the expansion of experience and research Hutton's hypothesis has been subjected to a severe test, which has not been followed by a confirmation sufficient to establish it as a theory based upon scientific truths. The inadequacy of such feeble agents as modern causes to produce the enormous results displayed in every mountain chain is not to be got over by magnifying the petty forces they exert, or by spreading them over an untold number of ages. The Huttonian theory has failed to give to geology fixed and permanent principles such as those by which Newton established astronomy. There exists, be it observed, no question or doubt with us as to the proved and certain laws of geology—the succession of strata, the order of fossil creations, the distinction of volcanic and sedimentary

* "Principles," vol. ii. p. 88. Mr. Roberts, the narrator of the events of this earthquake, nevertheless maintained that, three months after it had happened, he had perceived no sinking.

deposits, and a thousand other facts which go to form the basis of that science. We dispute only the fanciful and exaggerated views about the power of earthquakes, the action of modern denudation, and river erosion, and we exercise the privilege of doubt only in matters which have not been proved. To persist in a dogmatic adherence to mere conjectures is a baseless superstition, and we are happy to have some assurance for believing that it is dying out.

It was, therefore, with some regret that we read a recent declaration deliberately made and afterward confirmed by no less eminent an authority than Professor Huxley,* of his belief in the power of modern subterranean agencies to lift up a part of the bed of the Atlantic or Pacific, equal to the size of Europe, as high as Mont Blanc. We must avail ourselves of the privilege of what Tennyson calls "honest doubt" as to the power of any known agent upon or underneath the earth performing such a feat. If the long array of facts opposed to this theory enumerated above do not suffice to justify our doubts, we will strengthen them by one or two more examples, producing chapter and verse for each. One of the latest instances of a volcanic disturbance under the sea, affording the best opportunity of ascertaining how volcanoes really act under such circumstances, was that of the rise, off the coast of Sicily, in July, 1831, of Graham's Island. What happened was that, through a hole or vent in the sea-bed, heaps of ashes and floods of lava were sent up from below, and after these had accumulated to a height of 800 feet, so as to appear above the surface, they quietly subsided until they sank into an ordinary shoal or sandbank. But was the bed of the ocean lifted up? Nothing of the kind. Listen to Lyell: "No appearances observed, either during the eruption or since the island disappeared, give the least support to the

* We will quote his own words, as reported in *Nature*, November 4, 1880: "He was aware," he said, "of no biological or geological evidence at present accessible to render untenable the hypothesis that an area of the Atlantic or Pacific sea-bed as big as Europe should have been upheaved as high as Mont Blanc, and have subsided again any time since the palæozoic period, if there were any ground for entertaining it."

opinion promulgated by some writers that part of the ancient bed of the sea had been lifted up bodily."*

In fact, although granite and trap have often forced themselves in between other strata, and by lateral pressure have thrown them up into folds and anticlinals, it is not the habit of volcanoes to lift up masses of strata. This is the reason why there is no problem in the "theory of modern causes" more difficult to accept and to account for than the recourse to constant upliftings and downcasts of strata of enormous extent. Formerly the geologist talked lightly of elevations of the earth's crust, but to effect these, even in an hypothesis, is no longer so trifling a matter, since we have learned from the submarine discoveries of the Challenger, disclosing how vast beyond all previous knowledge are the depths of the ocean, that it involves the raising up of a solid rock-mass (thickness unknown) to a height not of three or four miles, but of eight or ten miles, beginning at the bottom of the sea and taking Mont Blanc on its back. Again, at what depth, and where, would Mr. Huxley apply his lever, and how would he fill up the breach in the sea-bed which this great fracture he proposes would occasion; and above all, where and how would he dispose of the water displaced by such a convulsion without inflicting a new deluge, and converting large part of some continent or other into sea? The professor has shown himself always so earnest in the pursuit of truth that we trust he will, with his usual candor, reconsider the evidence on this subject, and will not refuse to give some weight to the facts opposed to his view. He is not likely to retort with the answer of the Abbé Vertôt, "*Mon siège est fait.*" In examining the earthquake question, he will doubtless remember that there are districts on the earth's surface where, as in certain islands of the Malay Archipelago, earthquakes are chronic, and scarce a day passes without a shock. How happens it that these islands are neither raised up into mountains nor thrust down beneath the waves? Again, look at the city of Lima, destroyed eleven times in less than 300 years by shocks,

* Lyell's "Principles," vol. ii. p. 63.

and yet the Lima of to-day stands on the same level as that founded by the Spaniards in 1586.

Before we dismiss the subject of earthquakes our readers may not be displeased to have some information about the three which have lately occurred in Europe in 1880-81. That of Agram, though it sufficed to damage more or less every building in the town, having left scarcely a chimney standing, caused but slight loss of life. The town stands in the flat alluvial valley of the Save, a likely spot. Near the town crevices were opened in the ground, one of them three miles long. The shock was felt to the north at Vienna and at Debreczin, and to the south as far as Istria.

Few places in Europe have been so haunted by subterranean movements from the earliest times as the isle of Ischia. Homer, Pindar, and Virgil have in turn celebrated its throes, which they attributed to the struggles of the giant Typhœus, whom Jupiter had imprisoned by clapping the mountain Inarime (now Ipomeo) upon his body, just as he secured another revolutionary Titan, Enceladus, under Ætna. Desiring to relieve himself from the restraint of his uneasy couch, "*durum cubile*" as Virgil styles it, we may suppose the giant to have been the author of the commotion of March last, which shook all the south side of the island. Reverting to the sober history of Ischia, we have continued records of convulsions from the days of Strabo and Pliny onward. Indeed, not until A.D. 1300 did Ipomeo, the crest and center of the island, cease to pour forth lava and ashes, though now ranking among extinct volcanoes. The island has not escaped without a shock occurring nearly every year; but few have attained the severity of that of March 4, 1881, which concentrated its violence on the town of Casa Micciola, shaking down great part of its houses over the heads of the inhabitants, with great loss of life. So sudden was the catastrophe that the body of a cobbler was dug out from the ruins with his last between his knees, and that of a woman with the stocking she was knitting upon her hand. The part of the island exclusively affected consists of enormously thick beds of clay, similar to those over which the Campanian earthquake wreaked its ravages.

What specially distinguishes Ischia is the development of internal heat in those parts where the earthquake prevailed. Nowhere within so limited a space are there so many or such intensely hot mineral springs, whose waters are in part used for the cure of maladies, while the rest goes to scald pigs and wash clothes. Indeed, in this part of the island there seems to be no cold water whatever.* The soil is hot, the dry sand on the seashore is hot, and the earth breathes out from its crevices jets of intensely hot air, which is used medically for stufe or air-baths. Such copious emanations of heat, gas, and scalding water, indicating as they do a direct opening or communication with the interior of the earth, favorable to the discharge of electric energy, all combine to characterize Ischia as a very hot-bed of the earthquake.

The rich and lovely island of Chio, the scene of the third great earthquake, which began April 3, 1881, though standing upon the belt of subterranean commotion which we have mentioned, had not been subject in recent times to very serious tremors. It does not appear in Dr. Schmidt's Catalogue before 1859. The shock of the 3d was repeated on the 11th of April with such tremendous force as to overthrow what had been spared on the 3d. The ground swayed and rocked under it, shuffling the ruined walls to and fro, throwing them on the side opposite † to that in which they first fell. Indeed, there are instances of a second shock uncovering and releasing those buried under fallen houses at first, and allowing them to escape from their prison. Not until the 20th did the surface quiet down. In that time some 4,000 persons perished; from 8,000 to 10,000 were more or less maimed, and from 30,000 to 40,000 rendered houseless. Out of 250 shocks between the 3d and 12th, the intelligent correspondent of *The Daily News* tells us, 40 were capable of overthrowing a well-built house, but vibrations continued until June

* See Mr. George Spottiswoode's informing and entertaining "Lecture on a Tour in Italy."

† In the Cretan earthquake of 1846 one shock threw the minaret of a mosque on one side, but the next one set it upright again.—Schmidt, p. 38.

10th, when a shock threw down a Turkish minaret and a tottering wall. In the town of Chio the old fortress is utterly prostrated, but viewed from the streets many houses present their usual appearance, the fronts standing although the interior is down. The scene of this fearful and distressing catastrophe was the south-east corner of the island, consisting, as usual, of modern alluvial and slightly coherent deposits. Here the devastation of 42 out of a total of 75 villages occurred. The central strip or backbone of the island, of old limestone, sandstone, and slate, scarcely suffered at all. The physical aspect of the country is unaltered, and though the opposite coasts—Smyrna, Mytilene, etc.—were affected, the statement that the sea-bed between was raised is simply unfounded.

We have thus been at some pains to explain the probable connection between electricity and earthquakes; but the subject thus opened up does not end here. Sir William Thomson and other eminent men of science, now intent upon the acquisition, collecting, and storing of electric force, will, it is to be hoped, direct their attention to that storehouse of unlimited energy already filled within the bosom of the earth, and to the modes of turning these supplies to the use of man in lighting, warming, locomotion, and all other purposes to which this mysterious power may prove to be applicable; while they may, not improbably, be able to devise some means of averting the fearful calamity of the earthquake shocks in years to come.

THE QUARTERLY REVIEW.

THE PROGRESS OF MEDICINE.*

At a time when every pursuit of life is more or less cosmopolitan it would be curious if medicine, the most cosmopolitan of all things, did not celebrate its universal fraternity. The spirit of the age was upon it, and so the great congress has come, has spoken, and has gone, leaving behind the story of a great success. This story has been told from every point of view, philosophical and scientific, professional and social, and nothing has been left unsaid about its session. It was a success so pronounced as to make it an event of great and kaleidoscopic interest; and it is remarkable how, from different standpoints and distinct lines of thought, the present seems to have been regarded for medicine as an ending of one epoch and the beginning of another—a passing from the old to the new.

This was especially noticeable in the "general" addresses to the congress at large. The aims of the presidential addresses of the various sections were probably of necessity too restricted, and their tendencies too immediately practical, to admit of any very elevated or extended exposition of the actual condition and of the prospects of medicine. At the opening meeting, the president, Sir J. Paget, struck this note when speaking of the future. He said, "It will not be easy to match the recent past. The advance of medical knowledge within one's memory is amazing, whether reckoned in the wonders of the science not yet applied, or in practical results in the general lengthening of life, or, which is still better, in the prevention and decrease of pain and misery, and in the increase of working power." Prof. Virchow, in his address on "The Value of Pathological Experiments," although he kept strictly to his text, said, "We have reached the point which denotes the boundary between ancient and modern medicine." Prof. Huxley, in tracing the essential

* 1. International Medical Congress: Abstracts of the Communications to be made in the various Sections. Seventh Session. London: 1881.

2. Reports of the Meetings of the International Medical Congress in the Daily Papers and the Weekly Medical Journals, August 1st to 9th.

foundations of medicine in the biological sciences, observes the disappearance of older definitions of life, and says, respecting the new, "henceforward, as it appears to me, the connection of medicine with the biological sciences is clearly defined." M. Pasteur revealed by unimpeachable experiments (certainly epoch-making) new and far-reaching prospects in the prophylaxis of infectious disease. Speaking of the "changes which surgery has undergone during the last ten years," Prof. Volkmann says, "Great and unparalleled in the history of medical science have been those changes. Problems, thousands of years old, have been solved, or are, at any rate, approaching a sure solution; the desires of our fathers have been fulfilled beyond their hope and expectation." And the paper of Dr. Maurice Raynaud—written, but not read, by him, for it was his last tribute to medicine—defines the philosophical position of skepticism in medicine, and affirms the "moral certainties of medical science" in our time.

To-day, then, medicine looks back upon a generation of progress which has never been rivaled, which is indisputable, and can be distinctly measured. It has never been able to do so much for the relief of sickness and restoration of health. It possesses new powers both of investigating and treating disease. Its knowledge is greater, more positive, and more comprehensive. Its experience has never been so thoroughly tested, classified, and formulated into lesson and rule. At the same time there are not wanting warning voices to check any flight of airy conceit. The wits and satirists of to-day ply the same jests with the same stings of truth as in the times of Aristophanes and Martial; and the philosophy of our age in its great doctrine of the "survival of the fittest" indorses the opinion of Plato, that medicine should tend the men of good constitution and leave the weak and feeble to die out. Sir W. Hamilton asked bitterly whether medicine had made any progress since Hippocrates taught, and its modern developments are stigmatized as "barbarisms of civilization." Nor is it only among satirists and philosophers that such skepticism is found. Dr. Maurice Raynaud, in his altogether admirable paper on "Skepticism in Medi-

cine," remarking that "the list of skeptical philosophers contains so many names of doctors," asserts that "between skepticism and medicine there has always existed a certain natural affinity." Some of the most eminent physicians of our own day express the same unbelief, and find a ready justification in the historical records of inflammation. This must always have been the first study of medicine; and yet our treatment remains essentially that of the Egyptian papyri of the fourteenth century B.C. Much of our recent advance can only be described by an Irishism, as backward, from the practice of our forefathers to that of Hippocrates. Maxims he enunciated, which have been discarded by after ages, are now proclaimed as truths. Indeed, the very essence of modern progress seems to be, the more direct recognition and reliance upon the vis medicatrix naturæ, he affirmed—*ροῦθων φύσεις τηρεῖν*. No better definition than this could be given of the duty of the physician, to favor the natural effort toward recovery. Many leading physicians of to-day renounce all pretensions to cure, and affect to do little more than place the patient in the most favorable condition for recovery. They often seem to practice in the spirit of the aphorism of Celsus, "optima medicina est non uti medicina." Fashions in medicine wax and wane almost with the moon, and would seem to be governed by some mysterious law which regulates the cycle of their return. Theories, more or less bewitching, come and go like clouds. The very progress of medicine is mechanical rather than philosophical, of instrument rather than of principle. No great master has arisen to give to it a philosophical order and unity and write down its fundamental laws. Other sciences in their advance have freely given to it their aid in theory and analogy, discovery and invention. It has plowed with their heifers and worked with their tools. New forces have been placed in its hands, new faculties lent for its use. Its students have devoted health and life to the cultivation of minute portions of its domain. Masses of facts have been accumulated, and experience has been piled in huge heaps. Undoubtedly we know more of disease, but can we do more for its cure? So often have we to confess our impotence, so little is there that we can

accomplish, that the question *will* come, "Are our cures due really to our art rather than to the vis medicatrix of old? Are even the foundations of medicine as a science yet laid? Is our boasted progress development or but mere accumulation?"

It is certainly advisable to make sure before we speculate upon an advance, that the ground on which we stand is something like terra firma. Can we then assume that our position is so assured that the ensuing age will progress, in part at least, upon the lines in which we move? Will the future be the glorified sequel of the present? Do we possess truths of medicine which, imperfect and fragmentary as they may be, are yet, as far as they go, positive and lasting? Now, it is often asserted that medicine is not a science, and cannot at best be more than an enlightened empiricism—that it cannot, therefore, be presumed to be established upon any stable basis—and that, having no fundamental principles on which it may securely rest, the empiricism of to-day may be contradicted and superseded by the empiricism of to-morrow. But if it will not answer to any very rigid definition of a science, it is none the less scientific, both in spirit and doctrine. If there is not a science of medicine, medicine is certainly rooted and grounded in science. In truth, medicine is but part of the science of biology, and may be in some sense described as an applied science of biological doctrine. It rests upon the two large divisions of biology—*anatomy and physiology*; and its own peculiar studies of *pathology and therapeutics* are but specialized parts of physiology. The processes of pathology are all physiological, and are the ordinary sequences of certain causes which interfere to induce some deviation from normal conditions. That they stand in such a relation to the life of the being as to constitute "disease" is but an accidental, and not an essential, circumstance. To quote Comte,* "The state of disease is not a radically different condition from that of health. The pathological condition is to the physiological simply a prolongation of the limits of variation, higher or lower, proper to each phenomenon of the normal organism; and it can

* "Positive Philosophy," Book V. chap. i.

never produce any entirely new phenomenon." There is no real border between them—not even the assumption that the processes of pathology are retrogressive, since the bulk of those of physiology are of the same essential character. Also some pathological processes are of the reverse type—e.g., the increase in the muscular tissue of the heart in compensatory hypertrophy. Moreover, the most positive teachings of empirical medicine are always suspected until they are indorsed by these biological sciences. They form the ultimate court of appeal to which its questions are referred for decision, and clinical experience is rather the judgment-seat than the judge. So that if the name and dignity of a science are denied to medicine, it is indisputably based upon and governed by science. In such degree, then, as the doctrines of medicine are corroborated by biological facts, they may be taken as representing scientific truths. Much of modern physiological teaching may be swept away by the advancing tide of knowledge; but in so far as medicine embodies its permanent truths, in that degree will it also be permanent. Whether, therefore, it be termed a science or not, there is clearly such a thing as scientific medicine. Call it an art only, yet it can have no sound basis or positive knowledge unless it is informed by the scientific spirit. For "art, in any but its infant state, presupposes scientific knowledge; and if every art does not bear the name of a science, it is only because several sciences are often necessary to form the groundwork of a single art. So complicated are the conditions which govern our practical agency, that to enable one thing to be *done*, it is often requisite to *know* the nature and properties of many things." * Medicine is an art, but it is much more, and, as in some respects a science of other sciences, it has even been denominated a philosophy. Hippocrates seems to have considered that medicine could not be strictly termed a science, but it is hardly to be denied that it takes both the form and spirit of a science from the modern development of biology. So that we may accept its present position as durable, its progress as real, in so far as they represent biological truth.

* J. S. Mill, "System of Logic," Introduction.

Medicine, however, has always presented these two aspects—the scientific and the empirical. They are two natural supports on which it rests, two inherent forces by which it progresses. Whatever doctrine may in different ages have predominated, these have always been present. The contentions between the philosophical school of Cos, practicing from its observations in anatomy and physiology, and the empirical school of Cnidos, practicing from its observations of the operation of remedies, have been perpetuated to our own time, because they embodied these two essential factors in all true progress of medicine. It is not the difference between the man of theory and of practice, of study and action, for there is an empiricism in theory as well as a science in practice. The difference lies deep in the very nature of the things of medicine. While there is so much of the unknown in its study, there must be empiricism in its practice. It has often to attempt to solve problems of which it is almost entirely ignorant, and must therefore blindly follow any indication of success it may chance upon. Knowing little or nothing of certain processes of disease, it is guided by broad results, and that is empiricism. Knowing from previous investigation something of certain other processes, it is guided by its knowledge of their causation, and that is scientific medicine. The dissensions of bygone schools, based upon these two stand-points, have arisen from mistaking a part truth for the whole. Medicine is both empirical and scientific, and not either alone. Nor can it be said that there is any prospect of its ever changing this dual character, of losing its empiricism in a perfected science.

It cannot be admitted that the existence of empiricism is the reproach of medicine, or that it indicates the absence of all scientific principle, without which there can be no genuine advance. In all applied science a certain amount of empiricism necessarily exists, and the "empirical philosophy" defines its legitimate position. That there is more in medicine than in other sciences is due to the fact that it has to deal with matters of which so little is known. And its peculiar offense in medicine arises from the importance to man of the interests involved—

himself—in which he naturally thinks that scientific certainty would be so very preferable.

In appraising the present worth of empirical teaching it may be said that it represents some truth, but what the truth exactly is we do not know. It is truth in the ore, seen only in the dim gleam of granules in the midst of much dross. The metal is there, although we may not be able to say positively what it is. No inferences, then, can be drawn concerning the advance of medicine from the lessons of empiricism, except from the bare fact of their existence. They afford no other indication of the next step. One may look a short way ahead and see whither the beaten path of scientific inquiry is tending, but the progress of empiricism is a leaping from stone to stone across an untrodden country, not seeing where the next step will fall. And in this way gifted men of clearer sight have gone far in advance of their times, and have lighted upon facts which the toilsome road-making of science has taken long to reach. These are the fathers, the seers, of medicine, who have seen truths, the reasons of which only generations long after them have discovered.

But it may be objected, Does not all history refute the proposition that the facts of empiricism have a certain, if indefinite, value? How can they be admitted as representing in any degree truth, when age after age has so industriously and successfully busied itself in demolishing the affirmations of its predecessors. Can we possibly accept facts solely upon the teachings of empiricism, when we reflect that in other times they have been as implicitly believed and as plausibly maintained, only to be upset and derided by after generations. The history of medicine, however, confirms rather than refuses such credit to empirical results. It shows that the teachings of genuine empiricism have always had a basis of truth, that they have only been disproved in so far as the truth was incomplete. Every prominent school of the past is represented in our doctrine by some form or degree of the truth which gave them life. They have passed away, not because they had no truth in them, but because they had only a small part of truth, and mistook it for the whole.

But this is only the common way of mankind. We are so dazzled by the sudden blaze of light shining in dark places that we are unable for the time to perceive its limits. The new truth demonstrated in some things is applied to all problems as a universal and natural solution. However absurd and extravagant the past tenets of sound empiricism may seem, they always contained an element of truth, which, fractional and disguised as it may have been, gave them a vitality which preserved them until they were absorbed in larger, clearer truth. The swift revolutions of the circling years have winnowed the chaff from the grain, and have left for us the accumulated store.

From the very birth of recorded medicine we can trace its unbroken lineal descent in truths, first taught empirically, which we now hold. The great doctrine of Hippocrates, that the primary seat of disease is in the fluids of the body, has maintained, under the name of the "Humoral Pathology," a more or less prominent place in all succeeding ages. And the most recent tendencies of modern progress have changed its aspect rather than its position. The Empiric has never failed out of medicine, and indeed must always remain while its art is compelled to practice in advance of its science. The Methodics, with their principle of *strictum* and *laxum*, are represented by the increased or diminished vascular tonicity which forms so large an element in modern doctrine and treatment. The spirit of the Eclectics and the Skeptics is as emphatic and powerful among us as in the sects which bore these names. The mediæval Arabians were alchemists rather than physicians, but their idea of a philosopher's stone seems, according to certain chemists, to be on the point of realization in the resolution of all the elements into modifications of but one. In the Renaissance, the chemi-atric school, following Sylvius, who said that diseases are derangements of a fermentative process in the body resulting in excess of acid or alkali, are with us in the very name of a zymotic (*ζυμωτή*) class of disease. The series of the digestive processes are distinctly of the ferment type. And the acid secretions of gout, and the alkaline discharges of cholera, serve to remind us of facts dimly seen by them, and not very clearly by ourselves.

What has been called the "iatro-mathematical" school, which, after Borelli, interpreted vital motion by mechanical principles, would find many illustrations from the teaching of modern medicine. These principles are recognized as a substantial element in the processes and functions of the organism, and are a prime agency in the relief and cure of many affections. The "archeus" of Van Helmont was in reality the *vis medicatrix* which eminent physicians in all times have relied upon as the great agent of cure. Stahl gave to this force an entity which we still speak of in his term *anima*, or in that of his later works, *motus tonico-vitalis*. And after him Hoffman, as "nervous action," and Haller, as "irritability," gave to science the very expressions it still employs. These various ideas were the essence of the empirical practice of the times in which they respectively flourished. They were the kernels of truth inclosed in thick husks. So that history decidedly supports the proposition that there is in empirical results an inner nucleus of fact, however thickly it may be enveloped in worthless coverings, and however impossible it may be to guess what is its nature from the appearance it may for the time present.

It is obvious that if medicine has thus taken up the position of a biological science the fact is full of promise for its future. Whatever may be said of other sciences, that of biology is manifestly but in its youth. Its very birth as an integral science could only follow a certain maturity in other physical sciences which necessarily precede it in the great hierarchy. And if medicine has no scientific existence apart from biology, its future is of necessity bound up in that science. And just as biology is compelled in great measure to wait for the progress of its ancillary sciences, so has medicine to wait for the progress of biology. In the words of Prof. Huxley's address, "there could be no real science of pathology until the science of physiology had reached a degree of perfection unattained, and indeed unattainable, until quite recent times." The science of medicine is thus also in its early youth. It is but now awakening to its birthright in the realm of science. So there can be no wonder that its scientific progress has been hitherto so tardy and dubious. As funda-

mentally a department of biology, it could not advance in front of the entire science. By its researches it undoubtedly contributes to the progress of biology, but medicine can only be itself in advance of biology by virtue of its empiricism. Now, however, its growth must be progressive and substantial, since it is animated by the living spirit of science. Theoretically, at least, every physician is a trained biologist, and every dose of drugs a biological study.

Empiricism necessarily knows no law. Recognizing law, it ceases to exist. No glimpse of its future can therefore be obtained. Only with the advance of biology its possible area will be more and more circumscribed; and with better means to test and investigate its assertions, they will be the more quickly reduced to scientific expression. But its knowledge must always be temporary in its character and undergoing an unceasing transformation into science. It constantly discovers new material for science to digest and absorb. The immediate future of scientific medicine, however, may with some assurance be prognosticated from its present. So far as there is truly a science of medicine now, so far may it be foreseen what it will be. It must advance upon the lines laid down in the laws already known. Other laws, deeper and more fundamental, may be discovered which will give another bent to its progress. But in part at least it will certainly develop in the direction of the laws now demonstrated. To the extent in which these laws form part of a science of medicine will they take part in constructing its future.

Animated by a spirit of its own, and guided by laws of its own, medicine has thus an independent existence as a practical science—not of course independent of biology, but taking rank as one of its distinct and integral divisions. Intimately related to its sister-divisions, and freely giving to and borrowing from them, it yet lives and works in a sphere of its own. Thus it takes up from the world around fitting materials for its growth. It selects means and instruments from every art, and adapts them to its own use. It borrows theory, analogy, and illustration from all sciences, and constructs a philosophy of its own.

It grows into a form and organization which are its natural development. Rightly to estimate, therefore, both its present and its probable future, it is necessary to observe how this essential vitality is manifested in its whole body—how the same mood of the same spirit has actuated every part—and how the fundamental science of medicine is seen in the symmetrical progress of them all. And if the recent progress of medicine can be sketched in barest outline in this manner, it will afford some suggestions of what the near future will be. To determine in what direction it is most active now is to obtain strong presumption of the lines of its immediate advance. A simple scheme for such an inquiry would seem to be, to notice cursorily how medicine has advanced within the last generation, by (*a*) development from within of its own art and science, (*β*) adaptation and absorption of means and principles of other arts and sciences, (*γ*) the simple adoption and application of material from external sources. Not that this is assumed to form any philosophical analysis of its progress, based upon any essential mode to which it must conform—or that it particularly determines the conditions of its growth or offers any very precise conclusions. Much of the most valuable and characteristic increase in medicine has issued from the co-operation of all these processes, and cannot be ranked in any rigid classification. Any such analysis must be to a large extent general, indefinite, and approximative. But it has the advantage of observing the working of the spirit of medicine rather than its mere effects, and of exhibiting the unity underlying its divers manifestations. In this view we catch glimpses of medicine as an independent entity working out its own ideas, in its own ways, and with its own means. Appearing as a science developing its own constitution, it demonstrates a fact too frequently doubted. As a living science such a view may be said to show three normal processes of its growth which are always in operation—development, assimilation, and accretion.

It is neither necessary nor expedient to fix any precise period which shall limit the ken of our observation. There is no epochal date from which modern medicine reckons. The one

essential point for our purpose is to ensure that the energies which are now most active should be noted. And as each generation bears a stamp of its own impressed upon it by its predominant forces, it forms a natural term for the scope of an inquiry like this. But it need by no means be arbitrarily adhered to. The aim of this study is to observe the effects and development of the forces which are at work in the medicine of the present in order that their tendencies may be inferred, and it will but seldom lead us farther back than the last decade. The more recent these developments may be, the more significant are they of the outline of the immediate future.

In a paper like this, it is, of course, impossible to mention all, or even the greater part, of the developments and tendencies of recent medicine. All that can be done is to attempt to mark the most prominent and influential, and to observe their relations and the direction they seem likely to take. And with these the object must be illustration rather than description or demonstration. Again, its fundamental oneness with physiology gives to medicine a share in every physiological advance. Essentially parts of the same science, every fact and doctrine of the one has intimate relations with the other. The progress of the one is more or less immediately the progress of the other. It is only necessary, therefore, in observing the progress of medicine, to notice such matters as belong to that part of biology which is allotted to medicine, or, as perhaps it may be called in its scientific aspect, abnormal biology.

Incomparably the most important of the three essential processes of growth in medicine before described is that of development of its art and science by its own forces, with its own means, in its own ways. It is alone the necessary sign of real progress, the test of its existence as a science. Without such self-development it could have no independent being. It is the indisputable mark of inherent self-contained vitality. All other increase is more or less adventitious, heterogeneous, and symmetrical. To recognize medicine working out its own destiny under its own laws, is to give it rank as a true science.

And happily its largest growth has been of this character.

Although its problems are quite the most complicated, and its studies the most intricate known to mankind, it has labored upon them with signal success. And if it has not created a stately fabric of law and order like other physical sciences, it is rather because its material does not admit of such treatment than that medicine itself lacks the scientific spirit. The best definition of disease the world has known is that of Socrates, *ταραχος του σωματος*, and of the variation of these "disturbances" there is simply no end. No two cases of disease are alike, as no two men are alike in feature, disposition, and constitution; and the individual gives an individual stamp to every case. "It is not only that the living human body is, in both its material and indwelling forces, the most complex thing yet known, but that in our practical duties this most complex thing is presented to us in an almost infinite multiformity" (Sir J. Paget's Presidential Address). Thus, every dose of a drug must be to a certain extent an experiment, however clear the diagnosis of the disease may be, and however definitely the action of the drug may have been determined. But the laws which medicine has defined, and upon which it works, are as positive as those of any other science. The doubt and indefiniteness arise from its not having the means of measuring the force and exact application of these laws in any particular case. Not its science, but its means, are at fault. There is thus an element of vagueness in its dogmas and results which can probably be never eliminated. But as far as it can apprehend the extent in which its laws may operate in any given case, so far is it purely scientific.

Here, again, we meet the objection that medicine can make no true progress because it has no basis of elementary law on which to rest; that its laws are not primary and fundamental, and must therefore be liable to change in the advance of its science. It has no general principles, it is said, for the common foundation of its body of doctrine. Such a foundation is certainly essential for a safe and permanent superstructure. Has, then, our generation done anything in laying down these fundamental laws? Now, it must be admitted that as a department of biology it can only have an essential basis in life. As Pro-

essor Virchow emphatically remarks, "what is necessary for all branches of the great medical science in common is the comprehension of life." So that until life itself is defined, the prime factor in medicine remains undefined. But if life cannot be directly apprehended by medicine, the processes and results in which it is manifested are all more or less tangible to science. It is now thought of less as a property of certain organs or tissues (as in Bichat's "tripod of life") than as an indefinite force underlying the whole organism. If it cannot be defined as a physical force, it is practically as a physical force that it is seen working in the body. Medicine has, then, undeniably a scientific basis of elementary law and structure in pathology, which explores as physical processes all the deviations and aberrations of life. Again, to quote Professor Huxley, "pathology is a branch of biology—it is the morphology, the physiology, the distribution, the etiology of abnormal life." And, further, "pure pathology is that branch of biology which defines the particular perturbations of cell-life, or of the co-ordinating machinery, or of both, on which the phenomena of disease depend." This study, which shows what the "disturbances of the body" are in themselves, in the cells and tissues and function of the part involved, is a definite and positive foundation for the science of medicine: and in laying this foundation in broad deep lines, much can be shown to have been done in this generation.

Every question in medicine presents three steps. First, What *is* the disease?—a question of pathology. Next, How is it made known during life? what are its signs and symptoms?—a question of semeiology. And lastly, How is it to be treated?—a question of therapeutics. In all these studies absolutely scientific progress has been made in our time; in all law and order have increasingly prevailed; and while there are abundant signs of crudity and imperfection in modern doctrine, there is much that can be counted upon as positive knowledge. There is not a disease of which we do not know more than did our fathers.

In pathology, our generation has been signalized by the promulgation of Virchow's great doctrine—*omnis cellula e cellula*.

More or less directly it has been the seed-truth of the largest portion of recent progress. Great and important in itself, and in its influence upon biology generally, it has little less than revolutionized pathological study. It strikingly illustrates the essential identity of medicine with biology, and is, indeed, a biological law first demonstrated in the department of pathology. It is one of those fundamental laws which, once proved, are established for all time as an axiom of science. By its advent, vague theories of disease were displaced by a basis of demonstrable fact. Assumptions of "dyscrasiæ," or of "nervous irritability," which were supposed to explain the phenomena of disease, were dispelled; and the reign of pathological anatomy as the efficient explanation of morbid processes was universally acknowledged.

This reign has been prolific of all good for the advancement of medicine. The ultimate structure of the tissues and organs in which disease prevailed was exposed, and the very form-element often determined. A distinct structural basis was given to our knowledge which yielded a precision and definiteness such as no other conception could. If not the disease itself, it was certainly the morphological result of the disease. A world of new light was thus thrown upon the clinical recognition of morbid processes. Forms of disease which were semeiologically indistinguishable, but pathologically distinct, were discriminated and individualized. Specific varieties of the same type of disease were recognized from their commencement and distinguished throughout their course. Many constant phenomena previously remarked were strikingly elucidated. Large and important classes of morbid processes hardly recognized hitherto were clearly demonstrated. What are termed the "new growths" and the "degenerations" are practically the pathological gain of our time. The processes of every disease have been investigated with almost unexcepted increase of our knowledge. And its influence upon prognosis is still more remarkable. Indeed, it may be said that, in spite of the great advance in clinical study, prognosis has been absolutely dependent upon pathological anatomy for certainty and definiteness. The Prorrhetics of

the school of Cnidos, and the Prognostics of Hippocrates, seem almost to have anticipated all progress up to this era of pathological study. It cannot, perhaps, be said to have advanced semeiology by supplying it with new signs for the recognition of disease, but it has given exact interpretation of signs observed. Pathological anatomy and semeiology are not synchronous, but are separated by the point of death.

But it has always been felt that, great as is the advantage of this idea of disease, and fundamentally correct as it may be, it does not explain some of the most essential phenomena. It discloses clearly the seat of disease, determines its structural element, but only shows the active process by inference and deduction. The working of the disease in life is only seen by its effects in death. And these effects do not afford adequate information respecting important questions. Much of the morbid process is left quite in the dark. There is certainly more in disease than can be seen through the microscope. So the question comes, Is it not possible to get nearer to the essential disease. Can it not be observed at work in the living structure?

Considerations of this kind have of late years appeared to turn back the finger on the dial of medical philosophy to the ancient doctrine of humoral pathology, which seeks for the causes of disease, or at least its very first effects, in the fluids of the body. This doctrine cannot displace the anatomical study of pathology, but will rather be superimposed upon it. And although it may be essentially the faith of early medicine, it necessarily wears an aspect of the feeling and knowledge of our own day. But it is probably less a revulsion from the purely cell-and-tissue teaching of pathology than a partial manifestation of a subtle change which appears to be at present stealing over the entire spirit of medicine. This may, perhaps, be shortly expressed as a change from a spirit of analysis to a spirit of synthesis or constructiveness. In every department of modern medicine the analytical method has for some years past been supreme. Every question has been divided and subdivided until its essential part has been reduced to a mere vanishing point. In pathology varieties and differences have been described al-

most beyond count. A definite type of disease has been split up till nothing of its typical form is left. In the search for the morbid element the substantive disease has been lost. In diagnosis symptoms have been refined and signs exaggerated beyond all recognition. Diseases which consist in the association and correlation of a certain group of symptoms have lost their identity in an excessive predominance given to a single pathological sign. Therapeutics has been in principle reduced to the treatment of one or two urgent symptoms, and in the absence of any very definite symptoms to no treatment at all. Now, there is of course no question that the analytical method is the true and indispensable means of scientific investigation. Its domination in medicine has been simply a reflection of the times. The great and rapid progress of physical science excited in this kindred study a like spirit of inquiry. The use of instruments of scientific research, chiefly the microscope, stethoscope, and thermometer, gave to it a definite physical basis it greatly needed. And so habituated has it been to look at disease exclusively through these media, that it can hardly recognize anything that is not also purely physical. There can be no doubt that to this spirit the immense progress of recent times is chiefly due. No other method of investigation could have done so much for medicine or have given to it such positiveness. But medicine is more than investigation of disease merely, and after the puzzle has been taken to pieces to see what it consists of, it has to be put together again. So that a more constructive spirit has of late years passed over medicine in its every part. It seems to have been felt that the purely analytical method of study is not adequate for all the requirements of medicine. In laying stress upon certain parts of a disease, it lost sight to a great extent of the whole. The conception of the disease was lost in the prominence given to certain symptoms. Such prominence may be just and natural in the relation of these symptoms to others. But the disease itself is something more than symptoms—more than any number of symptoms together. It is rather the action and reaction of the "vital powers" upon the morbid lesions than any mere collocation of symptoms. And

of this aspect of disease, the analytical method, with its efficient means of physical investigation, took little or no note. It is something beneath the signs and symptoms with which this mode of inquiry busied itself. Thus there seems to have arisen in later years a disposition to regard disease in a larger and more comprehensive manner; to view more prominently the relation of morbid tissues and functions to the organism generally; to emphasize less the variations than the constitutional form of the disease; to recognize in some way or other the indefinable "life" which is hardly known to pathological anatomy. From such a synthetic spirit of study the revival of the humoral pathology, which is the mood of latter-day medicine, appears to have sprung. This doctrine restores pathology to clinical research, from which it was practically divorced by the anatomical study of disease. And if they can be united in practical investigation, a greater boon could hardly have been conferred upon medicine.

Hitherto, therefore, recent progress in pathology has been due almost exclusively to microscopic study. Organic chemistry has not probably realized the expectations it excited some years ago; and although its researches are regarded with hope in reference to pathology, it seems hitherto to have occasioned some disappointment. Pathology has doubtless received substantial and important aid from this science, but on the whole it seems rather to be traveling away from than drawing near to chemistry. Only the ultimate results of morbid processes can as a rule be recognized by chemical tests too far removed from the processes themselves to throw much light upon them. Their application to pathological conditions is also so ambiguous that no safe deductions can be drawn therefrom. To physiology chemical inquiry has rendered far more assistance. Again, from therapeutics pathology has received little aid. This is presumably on account of the backward state of our knowledge of the operation of drugs. If a definite physiological action could be with common certainty attributed to a drug, and the mode of estimating its action clearly known, therapeutics might cast much light upon morbid processes. From one or two modern

instances of this character such elucidation seems to be a promise of the near future. One might look for considerable aid, more or less direct, from physics, till it is remembered that in philosophical order pathology is a refinement of physiology, which itself takes up from physics that which it needs for its study and research.

Speaking broadly, it may probably be said that the great advance of our time in pathology consists in the establishment of a basis of elementary morbid lesions occurring in every organ and part of the body. This also appears to be derived from the large constructive spirit that has been noticed as prevalent in the medicine of to-day. The same morbid processes are seen in different structures of the body, with primarily the same effects. The effects are modified only by the function, and character of the tissue, of the part involved. These processes are the primary operations of pathology. The abnormal increase of connective tissue in the structure of any organ, for instance, ends in contraction, compression, and obliteration of the structural elements, with consequent loss of function. Inflammation occurring in any tissue leads to effusion, extravasation, and suppuration. All the elementary processes of pathology may be seen in different tissues and organs producing the same effects. Only the effects are manifested in a manner peculiar to each part. Embolism in the brain and in the lung causes in both a suspension of function, which is declared in the one by paralysis, in the other by dyspnoea. With the same fundamental lesions the disease is the same essentially, although wholly distinct in appearance. And since the great bulk of disease can be resolved into these fundamental processes, there is constituted a scientific and durable foundation for pathology, which is of the highest value and significance for philosophical medicine. The importance of such a constructive process can hardly be exaggerated, and all recent advance seems to develop along these lines. Diseases of different organs, which, until these essential elements were demonstrated, appeared to have nothing in common, are now seen to be results of the same process. Thus, a great tendency may be observed at work toward

the codification and unification of disease, and the resolution of complex forms into the simplest elements. It is the spelling out of disease in the very alphabet of pathology.

Among these general pathological processes inflammation must always take the first rank, both from the frequency and extent of its occurrence and the importance of its effects. It has always been in the annals of medicine a chief object of study. And it is remarkable, as showing the limitations of histological research—that with positive means of study the positive itself is not always attained, or that there is much more in pathological study than mere observation—that in our time theories have chased one another across the pathological stage on this well-studied subject. Just as Virchow's doctrine, based upon his cellular pathology, superseded all previous theories, so Cohnheim's views have later still supplanted his.

Pathology as a science has also made in late years a great advance in the discovery of the microphytic origin of certain specific diseases. The very fact that this class of disease is specific, always presenting the same phenomena, shows that there must be a cause also specific, single, and organic. This cause has been sought for in air, earth, and water, in the products of putrefaction, in the fluids of the body affected, and in a general theory of *contagium vivum*. And in a demonstration of this theory, it has at length been found. Several of these affections have been shown to be caused by the development of minute organisms within the system. It is affirmed that septicæmia has been traced to septic bacteria, relapsing fever to the spirilla, ague to the bacillus malarie, leprosy to the lepra bacilli, tuberculosis to the tubercle micrococcus, splenic fever to the bacillus anthracis, while the condition termed "chyluria" is caused by a nematoid known as the filaria. The fatal "wool-sorters' disease," which has so long baffled inquiry, has been demonstrated to be due to the bacillus anthracis, conveyed in the hair of animals that have died from the same cause, and communicated in the process of sorting. The multiplication of such organisms in the blood, and their consequent aggregation in the spleen, supplies a satisfactory explanation of

the salient phenomena of this class of disease. It is naturally inferred that other affections of this type have a like origin, although it has not been as yet disclosed by investigation carried on by the light of these discoveries. Further inquiry, however, has elicited much of the greatest interest. It has been shown in one case at least that while the constitutional disturbance may be to a great extent attributed to the process of propagation of these organisms in countless myriads, a lethal virus is formed, which may be isolated, and produced even in a solid form. This substance, free from the bacteria which gave rise to it, produces the characteristic effects of the disease in the course of which it was formed. Similarly a substance has been obtained which induces all the effects of simple fever. Here then is *materies morbi* isolated and in very substance. The part which the minute organisms play seems from all analogy to be that of a ferment; but in any case they are probably the efficient cause of the disease.

The question, of exceeding interest and importance, whether these divers micro-organisms are modifications in any manner of one primary root-form, or are of entirely specific growth, has been discussed of late with great acuteness, and confirmatory experiments have been adduced on both sides. If not of identical descent, they are undoubtedly closely allied one to another. These studies are all due primarily to M. Pasteur, whose researches have yielded so much immediate material profit that one thinks of him as of the orange tree standing in all the glory of blossom and fruit at the same time. His address was as fascinating in the unerring sequence of experiment as in the unbounded prospects of preventive medicine foreshadowed, and the masterly unraveling of some of nature's most occult secrets. Well might Mr. Simon say in his address to the Section of Public Medicine: "Never since the profession of medicine has existed has a field of such promise been before it." Apart from the immediate value of such researches as these, and the light they throw upon kindred questions, they are of the highest import for scientific medicine.

But besides the advance which pathology has made of late

years in great movements like these, there has been steady and substantial progress in the sedulous and laborious study of every form of disease. It would be obviously quite out of place to mention them here in detail. In one or two directions, however, the spirit of recent pathology is so well illustrated that they cannot be altogether omitted. This is strikingly the case with nervous diseases. A generation ago but little was known of the pathology of these affections. They were supposed, in great part at least, to be fundamentally variations of an immaterial principle, as "nervous irritability," and to have little basis in tissue changes. But as, one after another, morbid lesions were found for divers affections, nervous diseases were gradually brought into the common domain of pathology. Structural changes in the nerve-centers have been traced in all respects similar to general changes elsewhere, and with the same results of altered function. And these changes have been connected with certain signs by which they are recognized clinically. Thus, paralysis and convulsions, formerly regarded as distinct diseases, are now recognized as symptoms occurring in a variety of affections of the nervous system. And although neuro-pathology is still behind other parts of the science, it has at least established the great point that its basis is to be sought in organic changes of tissue substantially identical with morbid changes in other parts. Even in psychological medicine insanity has been so far demonstrated to be the result of definite cell-change as utterly to disprove the idea of an immaterial basis. There are still "functional" diseases and "neuroses" in which no tissue-change has been seen which is not rather the effect than the cause. But with constant research, the efficient cause is so frequently found in some distinct lesion that it seems doubtful whether there is such a thing as purely "functional" disease. Cerebral physiology itself is too ambiguous to afford much aid. Indeed, in view of the specific characteristics of man, physiology can only prosecute much of this study in the field of medicine. Even if "mind" is nothing but the "aggregate of the functions of the brain," and "'will' the resultant of these functions," physiology knows very little of it. But in no department of pathology has

so little progress been made as in what are termed the general diseases of the system. And this would seem fairly attributable to the intensely localizing tendency of recent research. Diseases of the blood elements have received, however, certain definite explanation. Gout, in the study of which, from the time of Sydenham, English medicine has always been pre-eminent, has been strikingly elucidated in its chemical results, though but slightly in its pathological processes. Diabetes has been beautifully studied as a question of physiology, but little as a disease. Of tetanus, chlorosis, and scrofula, little more is known than the descriptions of Hippocrates tell. It may be that in some development of humoral pathology as now understood these secrets lie hidden.

In days when the comparative aspect of all kinds of science is so well studied, it appears strange that in pathology it has been neglected. In view of the physiological solidarity of man and animals this method seems bursting with promise on every hand, especially in affording a distinction between "natural" and "acquired" disease. Also in the simpler and more easily determinable habits of food and life of animals, relations between faults of diet and hygiene, and their results in morbid changes, can be better traced. The necessity of broad and elevated views of medicine at the present day is forcibly suggested by the observation of Dr. Wilks, that philosophers (particularly Buckle) have long since remarked this gap in medical science. So fruitful and extensive does this field of research appear that it may be safely said that the lecture of Sir J. Paget on "Elemental Pathology," one of the earliest studies in this direction, will ever remain one of his most classic works.

In the study of the signs and symptoms of disease great and wide progress has been made in our generation. It, too, has received untold benefit from the anatomical mood of pathology which till lately so exclusively prevailed. A definite value and explanation have been given to symptoms, and signs of disease have received their true meaning. A direct effect of disease has been observed as the natural center for a group of symptoms, which, without such explanation, were isolated and unintelligible,

But this mode of pathological study has so multiplied lesions that clinical observation is at a loss to give them due recognition. Also many important elements of disease are unread by merely anatomical research; and, on the other hand, some of its most definite lesions have little semeiological import. Thus, in recent years, broad, constructive processes have been extensively at work. While local lesions have been clearly defined, the "constitutional" effects have been more observed; and these effects, always recognized as they have been by signs to which a purely empirical value was attached, are now measured with the certainty of scientific observation. "If men could be satisfied with pure knowledge, the extreme precision with which in these days a sufferer may be told what is happening, and what is likely to happen, even in the most recondite parts of his bodily frame, should be as satisfactory to the patient as it is to the scientific pathologist who gives him the information" (Huxley's Address). The relations of the topical disease to the whole system are thus determined, which is usually the main inquiry in each case. In great measure also it may be said that what used to be termed the "vital powers" are thus estimated.

Essentially constructive processes of this kind, determining the effects of a morbid condition upon the system generally, are the schemes of investigation represented by the stethoscope, ophthalmoscope, thermometer, and by urinoscopy. The study of disease by these means, if not of our generation only, has been elaborated and formulated in our time to an extent undreamt of by their authors. They note the relation of the morbid lesion to the life, how far the local or specific element of disease has affected the general powers of the system. No case of disease can be thoroughly known without the employment of these instruments. There is thus constituted a broad basis of medical knowledge which is common to every form of disease. And a certainty and precision is afforded to certain signs which must in all cases be inquired into, but which, before the use of such means, were the most vague and undefinable in medicine. By urinoscopy, for instance, the tissue-waste of the body is estimated with precision by the amount of urea ex-

creted. The presence or absence of each of the multifarious constituents of the urine has a definite pathological significance, while the occurrence of abnormal substances positively diagnoses disease. The position of albuminuria in present teaching illustrates recent progress in laying down this broad semeiological basis. In place of the three varieties of kidney disease to which first Bright attributed it, a large number of widely differing conditions are recognized in which it is seen. These conditions vary from some compatible with perfect health to others indicating the gravest organic lesions; and although of special significance in local disease, it occurs so generally in all serious affections as to constitute an invaluable test of constitutional derangement. Similarly, the stethoscope, complemented by the sphygmograph, reveals, with almost the clearness of ocular demonstration, the condition of the thoracic organs, and traces its relation to disease of other parts. Thus, the state and force of the respiration and circulation are defined with a certainty which must always be important with such essential factors in a question of disease. The use of the ophthalmoscope, both in special and general medicine, is probably the great triumph of this generation. It brought a new world of disease to light, and placed the eye in the hands of surgery as completely as any accessible part of the body; while the remarkable tolerance of surgical interference evinced by this organ, and the simply physical character of the function of the greater part of its structure, have given to surgery some of its happiest and most certain results. But now the physician has taken up the instrument, and employs it for the recognition of constitutional disease, which can often be detected in these delicate tissues earlier than in other parts of the system. A special value has also been attached to the observation of the retina from its anatomical relations, as almost a simple expansion of the brain substance. Again, the application of the thermometer, if more restricted in its scope, yet affords a wide range of observations of the most definite character, which are full of instruction in every variety of disease. Both in diagnosis and prognosis it is frequently indispensable as the basis of a correct opinion; and many affec-

tions have a typical thermometric scheme, which at once declares their character and progress, while deviations from this type evince the intensity and dangers of the attack. Electricity also materially contributes to this more precise determination of the general effects and conditions of disease; and other means, of smaller and more limited scope, assist to build up a broad basis of semeiology. This is of the utmost value to medicine, since it supplies a positive estimate of the vital powers and of the constitutional relations of local disease, which are fundamental factors in every case, and could otherwise be only vaguely guessed. These relations were noticed by Dr. M. Raynaud in his paper; when speaking of Pasteur's latest experiments, he asks, "What is this 'receptivity' which M. Pasteur brought about? What is it at bottom, if not that force of resistance which exists in every living being, differing according to the species, and also according to the individual? Is it not, in the main, the same thing as the *vis medicatrix naturæ*? Whatever we may say to it, it is one of the dominant forces of medical science. This force of vital resistance, this more or less receptivity of the disease, will be always the indispensable auxiliary to the doctor. . . . The incomparable difficulty of our art is the necessity of apportioning a just share to this element in the cure of disease." No case of disease can proceed far without encroaching upon the powers and functions of the system at large; and they must be included in any correct estimate of the case.

This progress in the definition of the signs and symptoms of disease may be described as progress in purely clinical research—i.e., in the first and most essential function of medicine. It is the recognition of the morbid processes during life, and the determination of their import. But it is more than the interpretation in life of pathology. If, on the one hand, pathology has disclosed lesions for which clinical study had to find the name and place of a disease, the latter study recognized affections of which pathology knows nothing. Thus, in our day, it has differentiated certain essentially distinct "continued fevers," and observes "clinical" varieties of the same pathological

disease, which are for all practical purposes distinct. This alone would vindicate medicine from any charge of want of scientific life.

In therapeutics our generation has witnessed a notable step in advance. Probably the most important step of its history, it may also be apparently ascribed to the analytical spirit which has possessed medicine for some time past. It consists in the substitution of a definite physiological aim in a remedial measure for the vague observation that "it does good." The one is of course the action of scientific, the other of empirical, medicine. Instead of administering a drug because general favorable results have been remarked from its use, a distinct purpose to induce a distinct physiological effect has been adopted. This principle is the necessary result of the clearer definition of disease and of the action of drugs. When the aggregate of symptoms presented by a disease was analyzed, one generally assumed a casual relation to the others which singled it out as the object of therapeutic attack. Or, again, the urgency of certain symptoms, or the irremediable character of the essential lesions rendering other treatment of no avail, gave a purely symptomatic aim to the entire plan of treatment. The principle of this method is, that no true progress in therapeutics can be made if more than one drug is employed, since a favorable result can be attributed to no single drug—so that only a single drug is to be administered for a single intention. And where no definite therapeutic indication can be observed no drug is to be used. This is the modern justification of "expectant" treatment. But disease is seldom a single pathological condition, with a single essential symptom, which a single remedy can relieve. And the latest tendency in therapeutics is rather to revert cautiously and partially to the combination of remedies, still following pathological indications, but not submitting the whole plan of treatment to a single dominant symptom. And this tendency may be plausibly referred to the more constructive or synthetic mood which seems of late to have come over medicine. It may be well illustrated in the modern treatment of consumption, which, graphically described by Hippocrates, and prominent among the

diseases of all ages, has ever reflected the ruling spirit of the time. In place of the sedative treatment, which sent sufferers to a moist, relaxing climate, like Madeira, a stimulating and bracing plan of open-air life is adopted, in cold breezy places like the Engadine. The former was the treatment of symptoms—e.g., the cough, which was much relieved by the warm, moist climate; the latter is the treatment of the essential disease, by improving the constitutional powers. Of the value of the one-drug treatment of disease there can be no doubt, nor that it is strictly scientific and has largely contributed to the advance of therapeutics. It is essentially the definite basis of therapeutics, and in appropriate cases gives the chief successes of medicine. But where disease is a complex condition, the treatment must also be complex. And even when a single cause can be defined, its effects and results give to the affection a complex character.

The essential aim of therapeutics may be stated as being the induction of a physiological process for the remedy of disease. The more nearly this induced process assumes a definite chemical or dynamic form, the more positive and direct is its action. And recent advance has greatly tended towards the statement of many therapeutic problems in chemical or mechanical terms. At the same time, the influence of the nervous system is so constant and direct in every process of the body, that these problems must always be distinctly physiological, and cannot be stated as purely chemical or mechanical. Its very constancy, however, practically neutralizes this nervous element as an interrupting influence in many cases, by its presence alike on either side of the equation, both in cause and effect. But if therapeutics has been thus simplified in one direction, it has made use of more complicated physiological processes in another. Some of its most certain and remarkable effects are obtained by acting upon the nerve-centers in the brain and spinal cord by which these effects are normally induced. Nervous influence is thus subordinated to, in place of disturbing, therapeutic plans. Very striking in this connection are the results which Dr. J. Chapman obtains by the precisely localized and measured action of hea-

and cold upon the central nervous system. And as physiology seems fast to be tracing more and more of the processes of the system to cerebral centers, a noble prospect for scientific therapeutics is disclosed.

This growing identification of therapeutics with physiology is also seen in the hygienic treatment of disease. Not only are hygienic measures used for general purposes of advantage, but distinct applications of hygiene are employed for a distinct physiological effect. Schemes of dietetics, for instance, are not only used with negative, precautionary aims, but with positive remedial intentions. By the prevalence of certain climatic conditions, natural or artificial, physiological states of the body are induced, and may be calculated upon as distinctly curative. Exercise may be so ordered that particular secretions and processes shall be stimulated, while others are unaffected. This mode of treatment has very largely displaced the use of drugs. It is not only simpler and more free from objection, but it is certainly more philosophical. A striking example may be mentioned in the treatment of mania of late, in which an enlightened and strictly enforced regimen has almost superseded "chemical restraint," just as the latter itself superseded mechanical restraint. It is noteworthy also that physiological therapeutics has greatly diminished the expectation of, if not the desire for, specifics. The definite action of a definite remedial measure has all the characters of a "specific," except ignorance of the mode of its operation.

It is worthy of note that against general specific diseases, as the exanthemata, therapeutics has produced no definite remedy. In these, if in any disease, with a single specific cause, it might have been expected that specific treatment would have been found. The antiseptic wave of thought that has spread over present-day medicine has suggested the use of "internal antiseptics" in diseases of this class. Salicylates, sulphites, quinine, and carbolates have all been used with this aim. This theory has also been supported by the bacterial origin of some of these affections, which has recently been demonstrated. In such a case these drugs are distinctly used as "germicides." But

although a certain success has attended their administration, it has not been so marked as to class them in any way as specific remedies, or even to afford much confirmation to the principle upon which they are given.

The advance of chemistry has produced some new remedies of importance. These, however, have not been derived from its "organic" section. Nor has any connection been traced between the chemical composition of the essential principle of a secretion and a chemical remedy. Chemical stimulants and depressants have been demonstrated for every organ, but they have been explained by no law of chemical or physical constitution. The rule established by Rabuteau, that the therapeutic energy of soluble metallic salts is in direct ratio with the atomic weight of the metal contained in the salt, suggests probabilities of the enunciation of such laws in the future. In many ways this is full of philosophical promise in therapeutics.

It cannot be said that electricity has been as successful in the remedial as in the diagnostic section of medicine. Yet much greater expectations were at first entertained of it in the former than in the latter. Its seeming analogy, if not identity, with the vital energy, and the demonstration of its presence in the organs of the body, gave strong ground for such hope. The subject has been well investigated, and a very precise code of electro-therapeutics has been established; and clear results of considerable value have been obtained. But, on the whole, the feeling seems to be one of disappointment with regard to its influence upon disease. And the most recent progress has, perhaps, tended still further to curtail large anticipations of benefit to be derived from its use, at the same time that it more clearly and positively defines the good of which it is capable. It has certainly been shown that whatever "life" may be, it is not electricity. It cannot, therefore, be expected that electricity will take a much higher place in medicine if it is simply a physical and not an essentially physiological force.

Within late years important advance has also been made in the principles of administration of drugs. The first axiom is, of course, that they should be applied to the part they are designed

to affect as directly as possible, or, as Prof. Huxley graphically puts it, "to introduce into the economy a molecular mechanism which, like a very cunningly contrived torpedo, shall find its way to some particular group of living elements, and cause an explosion among them, leaving the rest untouched." By the subcutaneous injection of the active principle of drugs, which is a recent improvement, the effect is more localized, producing less constitutional disturbance than in administration *per orem*. Moreover, the remedy acts more quickly, gets sooner into the general circulation, and avoids the risk of decomposition before absorption, which is incurred by admixture with the digestive fluids. The inhalation of suitable substances by smoking in a pipe or cigar is another illustration of the principle of the direct application of remedies. Physiology has cast such doubt upon the absorbing power of the skin as greatly to restrict external treatment by lotions and ointments.

Mention may here perhaps be best made of the employment of anæsthetics, which has formed a special study of our time. A great number of chemicals have been used more or less extensively, and their physiological effects closely compared. A certain, albeit infinitesimal, number of deaths while the patient has been under the influence of anæsthetics, has given warning of an element of danger attending their use. But, small as this fatality may be, it is alarming as being a risk expressly introduced by surgery for no immediate surgical purpose. And chloroform has hitherto had to bear the brunt of this discredit. By the method of "mixed narcosis"—the subcutaneous injection of narcotics before the administration of the inhalant—a smaller quantity of the latter is required and happier results obtained. The more correct principle of "local anæsthetization," in which the disturbance of the system is avoided, has been successfully adopted by means of the freezing effect of the ether spray. But the physical and mental quietude induced by inhalation must always keep for it a place in appropriate cases.

There is no philosophical distinction between medicine and surgery. It is a distinction of art, not of science. Special mention of surgery, therefore, would hardly be necessary here, if it

had not itself made remarkable scientific progress, and communicated to its twin-art impulses of great importance. It is commonly observed that the tendency of modern surgery is to become more conservative—that is, to dispense with the knife and rely more upon the recuperative and compensatory capabilities of the body. In this it has distinctly approached medical practice, and the line of demarcation between the two branches of the healing art is decidedly becoming more and more faint. While surgery, on the one hand, is falling back to a greater extent upon the ordinary powers of the system, medicine, on the other, is tending toward the adoption of manipulative measures. There are many diseases under the care of the medical side of the art, in which slight operative procedure is commonly required. Whole departments, both of study and practice, take up an intermediate position, one foot on medicine and one on surgery. Obstetrics and affections of the eye, ear, larynx, and skin, all are of this character. And in the general study of disease the two branches are inseparably blended. This is well seen in the instruments which late years have brought forth. The aspirator, for instance, for the removal of fluids from cavities, without an opening being left, is as much used in “medical” as in “surgical” cases. In fact, as the object of all instrumental means, both of diagnosis and treatment, is to bring within manipulative reach diseased structures, such an artificial distinction must gradually disappear in the progress of the art of medicine.

By the invention and improvement of means of this kind, our generation has made much disease of internal structures to be seen, felt, and handled. Thus there has arisen a large body of special knowledge and practice around many organs. The eye, ear, larynx, for instance, have respectively a peculiar art and science. And it is not to be expected that specialisms of this character will die out of medicine. As the study of each organ increases in extent and profundity, and the treatment of its diseases and defects in complexity and delicacy of procedure, special talent and culture will always be recognized. The specialism of learning, not of art, is to be deprecated in medicine. In the

essential identity of its science in every department is the integrity of medicine maintained. Recent progress in the "special" developments of practice has been sound and sure, in so far as it has traced its researches upon common pathological principles—a fact forcibly suggested by the discussions of the various Sections of the Congress.

In "conservative" surgery, the first thought is naturally directed to the conservation of the blood in operations. This is effected in a variety of ways. Operations are performed upon limbs from which almost every drop of blood has been forced back into the body by Esmarch's bandage. In vascular structures the same object is realized by the use of the *écraseur*, or a knife heated by galvanism. Modern jealousy concerning the loss of every drop of blood, compares strikingly with former practice, which employed bleeding to subdue or prevent inflammation attendant upon operations. Another development of conservative surgery of late years is in the excision of diseased joints, for which at one time the whole limb would have been condemned. By this means an arm or leg has been preserved with a degree of impairment of movement which renders it only less useful than the pre-diseased limb. The most happy circumstance in relation to this conservatism in surgery lies in the fact that it has sprung from straightforward and natural progress in principle and detail, rather than from any great discovery, or "wave of feeling," or brilliant advocacy of genius. It indicates the greater reliance upon the restorative powers of the system which now obtains, and the disposition to rule each case by the condition of the patient rather than by any hard and fast rules of art. Few things so emphatically attest the integral and fundamental advance of surgery.

Subcutaneous operations—e.g., section of bones and ligaments—is also a development of such conservatism. This mode of operation, however, introduces another great principle of modern surgery—viz., the rigid exclusion of the surrounding air from the wounded surfaces. The fact that noxious elements are commonly present in the atmosphere has enforced the universal adoption of antiseptic measures. Whether they are minute

organisms or not is a matter of keen discussion, which divides both theory and practice. The affirmative, as adopted particularly by Lister, entails the employment of most elaborate and multifarious means to ensure the exclusion of these morbid bodies; while those who adopt the negative are content with neutralizing, if not destroying, any possible septic poison by the simple application of antiseptics to the wound. The philosophical spirit in which this question is discussed is bright with promise for the future of surgery. The response of appeal to practice is somewhat oracular, and may be readily interpreted as favorable to either side. Experiments under simpler conditions than can be obtained in the body, concerning the action of bacteria upon the animal fluids, decidedly corroborate the idea that they are the active agents in the production of putrefactive processes in wounds. Pasteur, and lately Tyndall, have certainly proved that bacteria induce decomposition changes in liquids containing organic matter, which, when kept free from bacteria, remain unchanged for any length of time. But since it is admitted that the healthy tissues have a resistant power which precludes the development of these organisms in or upon them, such experiments suggest a caution how conclusions derived from an artificial experiment are transferred to the natural processes of the body. To that extent the question is still sub judice. The point up to which substantial agreement subsists is, that the use of antiseptics renders innocuous certain poisonous matters which are met with in a wound exposed to the air. The effect is practically the same, if the purification of the air is attained by thorough sanitary measures. This is strikingly seen in the comparison of the results of the antiseptic treatment in English and in German hospitals. In the former, the best statistics of the most complete antisepticism are hardly better than those of ordinary practice, because the sanitation of the wards is so efficient. In some of the largest and best known German hospitals, on the other hand, the most eminent surgeons had almost given up operating, because "hospital diseases" were so rife on account of inefficient sanitation. And here the use of elaborate antisepticism, as practiced by Lister, at once abolished

these diseases, and restored to the operator his art. Professor Volkmann's address seemed unable to exhaust the praises of antisepticism in surgery. He said, "By rescuing from the domain of chance the results of our labors, as far as they depend on operations and the treatment of wounds—and this will always remain the chief and especial work of surgery—the antiseptic method has elevated surgery to the rank of the latest experimental science. Never has a discovery been made in surgery which has even approached this in its benefits to humanity in general." And further on, "To-day we may say, with the deepest conviction, that the surgeon is responsible for every disturbance which occurs in a wound; that it is his fault if even the slightest reaction or redness is developed in it, or if an amputation is not healed by first intention." So that the great boast of surgical progress is, that it has well-nigh eliminated from the prospect of every case the accidental and extraneous forms of disease which not only imperil the very life, but at least check and modify the process of healing so as greatly to impair the results of the operation. Under the protection of efficient sanitary measures and antiseptics, the surgeon is enabled to plan his line of procedure undisturbed by any menace of danger which is not directly involved in the operation itself.

Since, therefore, the natural processes of healing are more within the command of surgery, operations of an increasingly formidable character have been carried out. Operations which were a generation past denounced as fatal and not to be thought of, now confer life and health and comfort upon thousands. The mortality has greatly diminished, and the operative art has taken up a definite and scientific position which was previously unknown to it. Such triumphs of surgery are simply too numerous to name in this place. Perhaps the most striking of them are the extirpation of deep-seated and important organs, such as the pancreas, spleen, kidney, and thyroid gland; and even, in cases recently reported, the removal of six inches of the stomach and pylorus by the great surgeon Billroth, and of three feet of the small intestine by a Strasburg surgeon, both with perfect recovery. The formidable operation of cutting for stone

is now practically abolished by an elaborate method of crushing and removal *per vias naturales*. An organ so thickly beset with the most delicate anatomical and physiological relations as the larynx, has been more than once successfully removed, and an artificial substituted for the natural voice-organ. Wounded joints, which would no long time ago have condemned the limb, are now freely opened, and successfully treated. But in nothing, perhaps, is this bold advance better shown than in abdominal surgery—operative procedure in which has always lain under the ban of being the last desperate resource. Now, men talk of the singular tolerance of surgical injury which the peritoneum shows. The successful removal of ovarian tumors is a triumph second to none in the history of surgery, and uterine tumors are fast submitting to surgical prowess. The oft-quoted calculation made by Lord Selborne concerning the operations in this class of disease of one surgeon only—Mr. Spencer Wells—may be repeated, as it so strikingly exhibits the benefits surgery may confer. He said that by the first 500 cases 10,000 years had been added to the lives of European women; and Mr. Spencer Wells has since stated that his succeeding operations had, upon the same data, given 10,000 more. Another kindred advance of modern art, as scientific if not as important as those above mentioned, is seen in plastic surgery. The operation of skin-grafting is in the best spirit of surgical science; and the transplantation of the cornea of a recently removed eye to replace the dimmed cornea of disease, is a more remarkable instance of the same character.

In the various "special" departments of surgery like progress has been made. The mechanical skill and spirit of the age have given to medicine instruments which have created a new science for many parts. The ophthalmoscope for the eye, the laryngoscope for the larynx, the otoscope for the ear, have placed these organs practically in the hands of the surgeon. Thus disorders are directly seen and treated, and faculties are restored and preserved, which would previously have been lost. But with this increasing cultivation of specialism, the integrity of medicine is maintained by the greater recognition of broad scientific princi-

ples as the only true basis in every speciality. They are refinements of surgery, and not in any way independent of it. All real progress has demonstrated the more clearly the essential oneness of local affections with those of the system at large. The character of recent progress in medicine is therefore well seen in this point also—viz., a greater precision of diagnosis, combined with the reduction of its multitudinous distinctions to broad fundamental principles.

β. Even a very slight and fragmentary notice, such as this, of our generation of medicine, proves incontestably that it has increased by the truest and most essential form of growth—that of organic and symmetrical development. It has been a growth of its own science by its own inherent powers. Its claim to the status of a living science is therefore demonstrated; and the very completeness and extent of this growth renders unnecessary any protracted notice of the increase of medicine by the assimilation or the mere accretion of material borrowed from without. It would also lead into matters too purely technical. Yet these two modes of growth are so essentially a part of the real progress of medicine, and mark such substantially distinct powers of its life, that they must not be altogether unnoticed.

The bulk of the material taken up by medicine from without is necessarily in a state of constant change. Some of it is gradually transformed until it becomes part and parcel of the very structure of medicine. Other portions are rejected as superfluous. While a considerable proportion preserves the condition in which it was first employed, and is neither on the one hand adapted for use, nor on the other thrown off. It is interesting to trace in certain things the various processes of assimilation, as the vitality of medicine changes them from the simple form in which they are first taken up to the final stage of absorption. There is thus no precise line of demarcation between the various processes, and they are to be seen in all stages. But the broad rule presents itself that where material adopted from without is so modified and altered to fit it for its new service as to have apparently become a very part of the tissue of medicine, it may

be said that it has been assimilated. If such a mode of growth is not of so high an order as that of self-development, it yet attests the possession of faculties which are the attributes alone of a science of independent organization.

The great mass of the means and material of medicine is in this condition of more or less complete assimilation. Its life is too restless and earnest to allow any promising addition to its power to lie for long untouched. No sooner is such a matter taken up than a close inquiry is instituted into its worth, and adaptations and modifications quickly follow. A new drug is brought into notice and tested, and if of any value is speedily put into various forms and used in many diseases. An instrument is devised, and if approved by experience its principle is modified and applied in a hundred ways. A theory floats in the air, and is found to cast light upon dark spots, and soon receives little alterations which illuminate obscure corners and odd crevices. The antiseptic theory now so prevalent is frequently appealed to for explanation of all manner of problems, and thus receives a different aspect—now bacterial, now chemical, now humoral—to give color to its divers applications. In this class, therefore, are to be placed those drugs which have been tested and approved, the action of which has been satisfactorily investigated. And in this direction considerable progress has certainly been made of late years. The ideal mode in which such knowledge is to be obtained is of course as a physiological experiment—a certain drug has a certain effect, and this effect is desiderated in certain affections. But although this scientific method has been employed occasionally, as by Fraser in the therapeutic use of Calabar bean, and by Lauder Brunton in the case of amyl nitrite, the chemical effect is more often first observed empirically, and afterward explained by scientific inquiry. There can be no doubt, however, that the former is the true method of therapeutic science, and it must increasingly prevail in the advance of medicine. The isolation of the active principle of a drug is also a decided approximation to scientific precision, which increasingly obtains. The clinical gain, however, is by no means beyond doubt in many cases, since the entire

drug is often seen to act with more advantage than the simple alkaloid, even when the alkaloid is practically the therapeutic power of the drug. Whether this is due to the chemical or molecular condition in which the active principle is present in the plant, or to the modifying influence of other slightly powerful substances, is not clear. There are many cases, for instance, in which cinchona is preferable to quinine, and *nux vomica* to strychnia.

Regarding the source of recent additions to our list of drugs, it is noticeable that while the vegetable kingdom supplies the great bulk of them, the animal kingdom which used to be the favorite repertory of medicaments has almost entirely disappeared. Chemistry has of late years given us most important remedies, and is certainly rich with promise of more. It has not, however, succeeded in the hope, once so freely expressed, of manufacturing substances of known chemical composition, such as quinine, by the short and direct processes of the laboratory, in place of the expensive and tedious method of plant growth. Nevertheless, its most recent researches still encourage such a hope.

In the enlightened practice of hydropathy a great power has always been recognized, but it cannot be said that its therapeutic function has as yet been established. Even in Germany, where baths have been most freely and extensively used in the treatment of disease, no clear rules for their employment have been developed. Their operation is so very complex, materially affecting all the processes of the body, that no very definite physiological indications of their remedial value have been forthcoming. The undisputed power they have must, however, preserve for them an important place in future therapeutics.

Gymnastics as applied to medicine has been examined with renewed care of late years, and striking results have been obtained; quite distinct from its beneficial effect as exercise, or the culture of physical powers, it has a decided remedial value in many affections. Many nervous and muscular disorders, and others in which it would seem that the main defect is in the controlling power of the brain, are certainly benefited by such treat-

ment. Often the brain can be thus educated so as to establish a normal functional action in the place of one that is aberrant or altogether wanting. As a child learns to walk, or an aphasic again to speak, and write his mother-tongue, so can the same process be often adopted with advantage in cerebral affections by what may be termed the somatic education of the brain. At all events, there is clearly a power in gymnastics which cannot be left unemployed in the progress of medicine. And as the ancients philosophically taught, there is, akin to this power, a beneficial effect in music upon certain disorders which is now and then in our day asserted with substantial proof.

Climatology is another study which has of late received a special medical development. As yet, however, little more than suggestions, probable but not demonstrated, have been derived from this source. But in view of the great and immediate influence of climatic conditions upon disease, and of striking circumstances in the mode of appearance of certain types of disease, which are also obviously determined by climatic conditions, it seems unquestionable that many secrets of the causation of morbid processes are involved in this study. Industrious and elaborate investigation has as yet, however, only yielded negative results. Barometric, magnetic, and hygrometric observations have all been more or less silent as to the origin and prevalence of disease. Certain thermometric limits have been traced, outside of which some diseases—e.g., yellow fever—do not appear. But these even have not been at all explained. Residence at certain altitudes has been proved to be of great benefit in some lung affections, but it has not been proved whether this is not more due to the Arcadian conditions of living and the purity of the air than to the slight reduction of barometric pressure in the atmosphere. The artificial production of rarefied and condensed atmospheres has, however, been successfully employed, chiefly in Germany, in respiratory affections. And the results have been so favorable that it would seem that only the cumbrousness of the instruments (large chambers into which the patient goes bodily, or miniature, but not at all small, gasometers) has prevented its general adoption.

In a mechanical age like ours, medicine has necessarily made substantial progress in the production of instruments of research, diagnosis, and treatment. Never before were instruments of such scientific precision and complexity employed in its service: and the purpose for which they are designed is almost uniformly as strictly scientific. There is hardly a function in the whole economy which may not be more or less definitely and positively measured by means of instruments of precision. Without them medicine could have no determinate knowledge of, or power over, disease.

γ. The last of the three modes of growth in medicine that have been here recognized is that of accretion, or the simple taking up into its body of certain materials from without, and effecting but slight, if any, modification in them. They are tested and approved, but are employed in the simple condition in which they were first taken up. Except, then, as an essential process in medicine, this mode of increase needs but little notice. Under this head are to be found all the items of the progress of medicine which are not included under those previously noticed. And while it is, perhaps, only to be distinguished from growth by empiricism by a certain, if indefinite, scientific knowledge of each particular matter, it is none the less a fundamental condition of growth in medicine. It is the stage of probation through which all material has generally to pass before absorption; or rather, it is the stage in which additions to the body of medicine, that have been proved of value, remain without further development. It comprises drugs which are used with beneficial effect, but to which no particular place or value in medicine has been assigned. Methods which have been employed with advantage, but have not received a distinct medical function to discharge; instruments of decided utility, but which have not been adopted as part of the regular procedure of practice; theories which look very like truth, but have not been positively demonstrated. The great characteristic of this category is its state of incessant flux and change. New material is constantly added, old and superfluous thrown off; some developed into completely assimilated part of medi-

cine, others simply confirmed, but unmodified, unadapted. As it may be said to be the zone in immediate contact with the outer world, it is the part of medicine which first feels the impact of external influences. It thus receives new impulses from all the cognate sciences, and is affected by every prevailing and vigor, therefore, of the faculties which are exercised in this form of growth, medicine must largely depend for extraneous support. And happily it has never had such free intercourse and intimate relations with the outer world, or been less shackled by pedantic and artificial restrictions.

Speaking generally, then, it may be said that the broad tendency of our generation of medicine has been constructive or synthetic in contrast with the infinitesimally analytical spirit of its earlier years. The prevalence of pathological anatomy as the dominant influence in medicine so divided and subdivided disease as utterly to confound any general scheme of classification, and its definiteness and clearness discredited the vague ideas and knowledge of therapeutics. But with the advance of physiology and the development of medicine, due greatly to physiological means of investigation, wider and deeper principles were given to every branch of its study. In pathology the great mass of disease has been reduced to a basis of elementary morbid lesions, modified only by the function and structure of the organ in which they appear. In semeiology the measurement of the extent of impairment of the vital processes supplies the basis for a definite estimate of every case of disease. In therapeutics general constitutional treatment increasingly supplants the tinkering of one or two symptoms only. And when the affection can be resolved into a single radical symptom, the remedy often attains the positiveness and completeness of a physiological demonstration; while still broader principles of hygiene frequently supersede entirely all other therapeutic measures. And there can be little doubt that therapeutics will increasingly become less a matter of drug-administration and more of physical and mental hygiene.

Another great tendency of recent medicine is toward a thorough and comprehensive system of prophylaxis. It recog-

nizes more and more that its care is for health as well as disease, to prevent as well as to cure. It traces the beginnings of disease in more or less avoidable violations of the conditions of health. And naturally this tendency must grow till it becomes the largest and most important part of medicine. It ought obviously to rule every stage of life, from the beginning to the end. Even before birth it can watch over and influence the new life through the mother. There is not a state or condition of existence in which it has not both warning and protection to offer against incidental evils. It is indisputable, for instance, that an immense amount of disease, infirmity, and misery would be avoided if medicine were given its due place in marriage questions. By the recognition of certain elementary rules of life, constitutional taints of disease may be held in check or altogether eradicated. Nor will the most punctilious observance of common health laws be too irksome or onerous as they gradually become almost the first part both of the education and conditions of existence of even the poorest citizen.

In what is termed "public hygiene" results of the most striking and important character have already been obtained. Even by the rudimentary practice of sanitation, which yet alone obtains, the most terrible forms of disease have been banished from among us. The plague and leprosy have practically disappeared in every civilized country. From the same cause other diseases have assumed a much milder form. The virulent type of dysentery which Sydenham described has gone, and surgeons of our own time speak of the mitigated form in which syphilis prevails as compared with their earlier acquaintance with it. With efficient sanitary manners, of which those now in use are but the alphabet, diseases caused by specific poisons, as small-pox, typhoid, hydrophobia, etc., will in all probability entirely disappear. In relation to sanitary police, diseases range themselves under two heads, those having an adventitious origin extraneous to the body, and those arising from causes within and pertaining to the human system. And as the knowledge and practice of hygiene advance, the former class of diseases must be greatly diminished and their virulence mitigated, and in some

bright future perhaps they will be wholly exterminated. And wind and doctrine of the scientific world. Upon the sensibility it is to this class that the greatest mortality has always been attributable.

Nor can there be any doubt that a true hygienic code of living contains the promise of longevity. And since it directly tends to the conservation of the natural vigor and functions of the body in the individual, it would follow that its culture by the community at large would also improve the national health and promote its length of life. As yet, indeed, the prolongation of the average term of life in the nation is due rather to a certain reduction in the infant mortality than to an actual addition to the average life. The large number of deaths of children under the age of one year has been, and in many parts of the country is now, absolutely scandalous. Their diminution is always among the first achievements of a scheme of public hygiene. In all conditions of life, however, vice and dirt must be ever the prolific source of disease. Moreover, the higher tension of a more crowded and restless age must of necessity generate disease of special types. The new demands which the development of civilization makes upon human energies and faculties, will also give rise to new affections, until, at least, the body becomes habituated to the new conditions of existence. And as the diseases we attribute to the aggressions of civilization upon man's powers are insidious and progressive, they are often chronic and intractable. But since in such cases the causation is usually directly traceable, the remedy, whether prophylactic or curative, will also be direct and positive. They need not, therefore, affect our hope of a future of better health and less disease. The fact that hereditary diseases change their form in descent from generation to generation, shows that they arise from a subtle faulty condition of the constitution, which can be combated by prophylactic medicine alone. And as few people are free from some lurking tendencies to a special disease, the advantage in the aggregate of efficient hygienic culture must be incalculable. In no way can a generation do so much for its posterity as by transmitting to it impulses of better and longer life.

Such prospects as are thus opened up for medicine are of the noblest and most important character. They clothe it with the dignity of the guardianship of at least the physical future of the human race. It is, however, with this development of medicine that the intensely realistic spirit now prevalent is least fitted to deal. With so much of science it has too little philosophy. Emphatically as the science of medicine may repudiate all animistic views of life, its art must practically recognize them in some sense as representing a force in addition to, if not independent of, the definable forces of man's nature. Even if it is regarded merely as the aggregate, the focus, of other known physical forces, it is, as such only, different and distinct from them all. And probably no admonition could be more timely and pertinent in the present mood of medicine than that of the venerable Helmholtz, of Berlin (*Brit. Med. Journal*, Aug., 1878), "Our generation has suffered under the influence of spiritualistic metaphysics; the coming one will have to be on its guard against materialistic philosophy."

THE WESTMINSTER REVIEW.

THE GEYSERS OF THE YELLOWSTONE.

The traveler by railway across the American continent, after traversing several hundred miles of barren plain and sandy desert, finds at last that the line begins sensibly to descend. The panting engine moves along with increasing ease and diminished noise as it enters a long valley that leads out of the western plains, sweeping by the base of high cliffs, past the mouths of narrow lateral valleys, crossing and recrossing the water-courses by slim creaking bridges; now in a deep cutting, now in a short tunnel, it brings picturesque glimpses into view in such quick succession as almost to weary the eye that tries to scan them as they pass. After the dusty monotonous prairie, to see and hear the rush of roaring rivers, to catch sight of waterfalls, leaping

down the crags, scattered pine-trees crowning the heights, and green meadows carpeting the valleys, to find, too, that every mile brings you further into a region of cultivated fields and cheerful homesteads, is a pleasure not soon to be forgotten. The Mormons have given a look of long-settled comfort to these valleys. Fields, orchards, and hedgerows, with neat farm buildings and gardens full of flowers, remind one of bits of the old country rather than of the bare, flowerless settlements in the West. But the sight of a group of Chinamen here and there at work on the line dispels the momentary illusion.

Winding rapidly down a succession of gorges or cañons (for every valley in the West seems to be known as a cañon), the traveler finds at last that he has entered the "Great Basin" of North America and has arrived near the margin of the Great Salt Lake. Looking back he perceives that the route by which he has come is one of many transverse valleys, hollowed out of the flanks of the noble range of the Wahsatch Mountains. This range serves at once as the western boundary of the plateau country and as the eastern rim of the Great Basin, into which it plunges as a colossal rampart from an average height of some 4,000 feet above the plain, though some of its isolated summits rise to more than twice that altitude. From the base of this great mountain-wall the country stretches westward as a vast desert plain, in a slight depression of which lies the Great Salt Lake. By industriously making use of the drainage from their mountain barrier, the Mormons have converted the strip of land between the base of the heights and the edge of the water into fertile fields and well-kept gardens.

Everybody knows that the Great Basin has no outlet to the ocean; yet nobody can see the scene with his own eyes and refuse to admit the sense of strange novelty with which it fills his mind. One's first desire is naturally to get to the lake. From a distance it looks blue enough, and not different from other sheets of water. But on a nearer view its shore is seen to be a level plain of salt-crusted mud. So gently does this plain slip under the water that the actual margin of the lake is not very sharply drawn. The water has a heavy, motionless, lifeless

aspect, and is practically destitute of living creatures of every kind. Fish are found in the rivers leading into the lake, but into the lake itself they never venture. Nor did we see any of the abundant bird-life that would have been visible on a freshwater lake of such dimensions. There was a stillness in the air and on the water befitting the strange desert aspect of the scenery.

After looking at the water for a little, the next step was of course to get into it. The Mormons and Gentiles of Salt Lake City make good use of their lake for bathing purposes. At convenient points they have thrown out wooden piers, provided with dressing-rooms and hot-water apparatus. Betaking ourselves to one of these erections, my companion and I were soon fitted out in bathing costumes of approved pattern, and descending into the lake, at once realized the heaviness of the water. In walking, the leg that is lifted off the bottom seems somehow bent on rising to the surface, and some exertion is needed to force it down again to the mud below. One suddenly feels top-heavy, and seems to need special care not to turn feet uppermost. The extreme shallowness of the lake is also soon noticed. We found ourselves at first barely over the knees; so we proceeded to march into the lake. After a long journey, so long that it seemed we ought to be almost out of sight of the shore, we were scarcely up to the waist. At its deepest part the lake is not more than about fifty feet in depth. Yet it measures eighty miles in length, by about thirty-two miles in extreme breadth. We made some experiments in flotation, but always with the uncomfortable feeling that our bodies were not properly ballasted for such water, and that we might roll over or turn round head downmost at any moment. It is quite possible to float in a sitting posture with the hands brought round the knees. As one of the risks of these experiments, moreover, the water would now and then get into our eyes or find out any half-healed wound which the blazing sun of the previous weeks had inflicted upon our faces. So rapid is the evaporation in the dry air of this region that the skin after being wetted is almost immediately crusted with salt. I noticed,

too, that the wooden steps leading up to the pier were hung with slender stalactites of salt from the drip of the bathers. After being pickled in this fashion we had the luxury of washing the salt crust off with the douche of hot water wherewith every dressing-room is provided.

It was strange to reflect that the varied beauty of the valleys in the neighboring mountains, with their meadows, clumps of cottonwood trees, and rushing streams, should lead into this lifeless stagnant sea. One could not contemplate the scene without a strong interest in the history of the Great Salt Lake. The details of this history have been admirably worked out by Mr. G. K. Gilbert. Theoretically we infer that the salt lakes of continental basins were at first fresh, and have become salt by the secular evaporation of their waters, and consequent concentration of the salt washed by them out of their various drainage basins. But in the case of the Great Salt Lake, the successive stages of this long process have been actually traced in the records left behind on the surface of the ground. At present the amount of water poured into the lake nearly balances the amount lost by evaporation, so that on the whole the level of the lake is maintained. There are, however, oscillations of level, dependent, no doubt, upon variations of rainfall. When the lake was surveyed by the Fortieth Parallel Survey in 1872, its surface was found to be eleven feet higher than it was in 1866. During the last few years, on the other hand, the lake has been diminishing. The Mormons have had to build additions to the ends of their bathing piers, from which the water had receded. There has been considerable anxiety too at Salt Lake City on the subject of the diminished rainfall, which has seriously affected the supply of water for irrigation and other purposes.

That the aspect of this part at least of the Great Basin was formerly widely different is conclusively proved by some singular features, which are among the first to attract the notice even of the non-scientific traveler as he journeys round the borders of the lake. Along the flanks of the surrounding mountains there runs a group of parallel level lines, so level indeed that when

first seen they suggest some extensive system of carefully engineered water-ways. On a far larger scale they are the equivalents of our well-known Parallel Roads of Glen Roy. Mile after mile they can be followed, winding in and out along the mountain declivities, here and there expanding where a steamlet has pushed out a cone of detritus, and again narrowing to hardly perceptible selvages along steeper rocky faces, but always keeping their horizontality and their proper distance from each other. That these terraces are former shore-lines of the lake admits of no doubt. The highest of them is 940 feet above the present surface of the lake, which is 4,250 feet above the sea. Hence when the lake stood at the line of that terrace, its surface was 5,190 feet above sea-level. Now it has been found that the highest terrace corresponds with a gap in the rim of the basin, lying considerably to the north of the existing margin of the lake. Consequently, when the lake stood at its highest level, it had an outlet northward into the Snake River, draining into the Pacific Ocean, and must thus have been fresh. Moreover, search in the deposits of the highest terrace has brought to light convincing proof of the freshness of the water at that time, for numerous shells have been found belonging to lacustrine species. At its greatest development the lake must have been vastly larger than now—a huge inland sea of fresh water lying on the western side of the continent, and quite comparable with some of the great lakes on the eastern side. It measured about 300 miles from north to south, and 180 miles in extreme width from east to west. Into this great reservoir of fresh water, fishes from the tributary rivers no doubt freely entered, so that on the whole a community of species would be established throughout the basin. But when, owing to diminution of the rainfall, the lake no longer possessed an outlet, and in the course of ages grew gradually salt, it became unfit for the support of life. Ever since this degree of salinity was reached the rivers have been cut off from any communication with each other. These are precisely the conditions which the naturalist most desires in tracing the progress of change in animal forms. During a period which, in a geological sense, is comparatively

short, but which, measured by years, must be of long duration, each river-basin has been an isolated area, with its own peculiarities of rock-structure, slope, vegetation, character of water, food, and other conditions of environment that tell so powerfully on the evolution of organic types. A beginning has been made in working out the natural history of these basins; but much patient labor will be needed before the story can be adequately told. There are probably few areas in the world which offer to the student of evolution so promising a field of research.

In the course of my brief sojourn in the region, I made an observation of some interest in regard to the history of the former wide enlargement of the Great Salt Lake. The Wahsatch Mountains, which rise so picturesquely above the narrow belt of Mormon cultivation between their base and the edge of the water, have their higher parts more or less covered, or at least streaked, with snow, even in midsummer, though at the time of my visit, by reason of the great heat, and, I suppose, in part also of a diminished snowfall, the snow had almost entirely disappeared. But any cause which could lower the mean summer temperature a few degrees would keep a permanent snow cap on the summits, and a little further decrease would send glaciers down the valleys. That glaciers formerly did descend from the central masses of the Wahsatch range is put beyond question by the scored and polished rocks, and the huge piles of moraine detritus which they have left behind them. These phenomena have been well described by the geologists of the Fortieth Parallel Survey, and I could fully confirm their observations. But I further noticed at the Little Cottonwood Cañon that the moraines descend to the edge of the highest terrace, and that the glacial rubbish forms part of the alluvial deposits there. Hence we may infer that at the time of the greatest extension of the lake the Wahsatch Mountains were a range of snowy alps, from which glaciers descended to the edge of the water. Salt Lake City, being nearly on the same parallel of latitude with Naples, the change to the former topography would be somewhat as if a loftier range of glacier-bearing Apennines were to rise in the south of Europe.

One leading object of our journey was to see the wonders of the Yellowstone—that region of geysers, mud volcanoes, hot springs, and sinter-beds, which the United States Congress, with wise forethought, has set apart from settlement and reserved for the instruction of the people. In a few years this part of the continent will no doubt be readily accessible by rail and coach. At the time of our visit it was still difficult of approach. We heard on the way the most ominous tales of Indian atrocities committed only a year or two before, and were warned to be prepared for something of the kind in our turn. So it was with a little misgiving as to the prudence of the undertaking that we struck off from the line of the Union Pacific Railway at Ogden and turned our faces to the north. Ogden is the center at which the railway from Salt Lake City and that from northern Utah and Idaho join the main trans-continental line. The first part of the journey passed pleasantly enough. The track is a very narrow one, and the carriages are proportionately small. We started in the evening, and sitting at the end of the last car, enjoyed the glories of a sunset over the Great Salt Lake. Next day about noon brought us to the end of the railway in the midst of a desert of black basalt and loose sand, with a tornado blowing the hot desert dust in blinding clouds through the air. It was the oddest “terminus” conceivable, consisting of about a score of wooden booths stuck down at random, with rows of freight wagons mixed up among them, and a miscellaneous population of a thoroughly Western kind. In a fortnight afterward the railway would be opened some fifty miles farther north, and the whole town and its inhabitants would then move to the new terminus. Some weeks afterward, indeed, we returned by rail over the same track, and the only traces of our mushroom town were the tin biscuit-boxes, preserved-meat cans, and other débris scattered about on the desert and too heavy for the wind to disperse.

With this cessation of the railway all comfort in traveling utterly disappeared. A “stage,” loaded inside and outside with packages, but supposed to be capable of carrying eight passengers besides, was now to be our mode of conveyance over the

bare, burning, treeless, and roadless desert. The recollection of those two days and nights stands out as a kind of nightmare. I gladly omit further reference to them. There should have been a third day and night, but by what proved a fortunate accident we escaped this prolongation of the horror. Reaching Virginia City (!), a collection of miserable wooden houses, many of them deserted—for the gold of the valley is exhausted, though many Chinese are there working over the old refuse heaps—we learned that we were too late for the stage to Boseman. Meeting, however, a resident from Boseman as anxious to be there as ourselves, we secured a carriage, and were soon again in motion. By one of the rapid meteorological changes not infrequent at such altitudes, the weather, which had before been warm, and sometimes even hot, now became for a day or two disagreeably chilly. As we crossed a ridge into the valley of the Madison River, snow fell, and the mountain crests had their first whitening for the season as we caught sight of them, peak beyond peak, far up in to the southern horizon. Night had fallen when we crossed the Madison River below its last cañon, and further progress became impossible. There was a "ranch," or cattle-farm, not far off, where our companion had slept before, and where he proposed that we should demand quarters for the night. A good-natured welcome reconciled us to rough fare and hard beds.

On the afternoon of the third day we at length reached Boseman, the last collection of houses between us and the Yellowstone. A few miles beyond it stands Fort Ellis, a post of the United States army, built to command an important pass from the territory to the east still haunted by Indians. Through the kind thoughtfulness of my friend Dr. Hayden, I had been provided with letters of introduction from the authorities at Washington to the commandants of posts in the West. I found my arrival expected at Fort Ellis, and the quartermaster happened himself to have come down to Boseman. Before the end of the afternoon we were once more in comfort under his friendly roof. And here I am reminded of an incident at Boseman which brought out one of the characteristics of travel in America,

and particularly in the West. It may be supposed that after so long and so dusty a journey our boots were not without the need of being blacked. Having had luncheon at the hotel, I inquired of the waiter where I should go to get this done. He directed me to the clerk in the office. On making my request to this formidable personage, seated at his ledger, he quietly remarked, without raising his eyes off his pen, that he guessed I could find the materials in the corner. And there, true enough, were blacking-pot and brush, with which every guest might essay to polish his boots or not, as he pleased. In journeying westward we had sometimes seen a placard stuck up in the bedrooms of the hotels to the effect that ladies and gentlemen putting their boots outside their doors must be understood to do so at their own risk. In the larger hotels a shoe-black is one of the recognized functionaries, with his room and chair of state for those who think it needful to employ him.

Of Fort Ellis and the officers' mess there, we shall ever keep the pleasantest memories. No Indians had now to be kept in order. There was indeed nothing to do at the fort save the daily routine of military duty. A very small incident in such circumstances is enough to furnish amusement and conversation for an evening. We made an excursion into the hills to the south, and had the satisfaction of starting a black bear from a cover of thick herbage almost below our feet. Not one of the party happened to have brought a rifle, and the animal was rapidly out of reach of our revolvers, as he raced up the steep side of the valley, and took refuge among the crags and caves of limestone at the top.

Being assured that the Yellowstone country was perfectly safe, that we should probably see no Indians at all, and that any who might cross our path belonged to friendly tribes, and being further anxious to avoid having to return and repeat that dismal stage journey, we arranged to travel through the "Yellowstone Park," as it is termed, and through the mountains encircling the head-waters of the Snake River, so as to strike the railway not far from where we had left it. This involved a ride of somewhere about 300 miles through a mountainous region still in its

aboriginal loneliness. By the care of Lieutenant Alison, the quartermaster of the fort, and the liberality of the army authorities, we were furnished with horses and a pack-train of mules, under an escort of two men, one of whom, Jack Bean by name, had for many years lived among the wilds through which we were to pass, as trapper and miner by turns; the other, a soldier in the cavalry detachment at the fort, went by the name of "Andy," and acted as cook and leader of the mules. The smaller the party, the quicker could we get through the mountains, and as rapidity of movement was necessary, we gladly availed ourselves of the quartermaster's arrangements. Provisions were taken in quantity sufficient for the expedition, but it was expected we should be able to add to our larder an occasional haunch of antelope or elk, which in good time we did. So, full of expectation, we bade adieu, not without regret, to our friends at Fort Ellis, and set out upon our quest.

The reader may be reminded here that the Yellowstone River has its head-waters close to the watershed of the continent, among the mountains which, branching out in different directions, include the ranges of the Wind River, Owl Creek, Shoshonee, the Tetons, and other groups that have hardly yet received names. Its course at first is nearly north, passing out of the lake where its upper tributaries collect their drainage, through a series of remarkable cañons till about the latitude of Fort Ellis, after which it bends round to the eastward, and eventually falls into the Missouri. We struck the river just above its lowest cañon in Montana. It is there already a noble stream, winding through a broad alluvial valley, flanked with hills on either side, those on the right or east bank towering up into one of the noblest ranges of the Rocky Mountains. Here, as well as on the Madison, we met with illustrations on a magnificent scale of the general law of valley structure, that every gorge formed by the convergence of the hills on either side has an expansion of the valley into a lake-like plain on its upper side. For several hours we rode along this plain among mounds of detritus, grouped in that crescent-shaped arrangement so characteristic of glacier-moraines. Large blocks of crystalline

rock, quite unlike the volcanic masses along which we were traveling, lay tossed about among the mounds. One mass in particular, lying far off in the middle of the valley, looked at first like a solitary cottage. Crossing to it, however, we found it to be only a huge erratic of the usual granitoid gneiss. There could be no doubt about the massiveness of the glaciers that once filled up the valley of the Yellowstone. The moraine mounds extend across the plain and mount the bases of the hills on either side. The glacier which shed them must consequently have been here a mile or more in breadth. All the way up the valley we were on the outlook for evidence as to the thickness of the ice, which might be revealed by the height at which either transported blocks had been stranded, or a polished and striated surface had been left upon the rocks of the valley. We were fortunate in meeting with evidence of both kinds.

I shall not soon forget my astonishment on entering the second cañon. We had made our first camp some way farther down, and before striking the tent in the morning had mounted the hills on the left side and observed how the detritus (glacial detritus, as we believed it to be) had been rearranged and spread out into terraces, either by the river when at a much higher level than that at which it now flows, or by a lake which evidently once filled up the broad expansion of the valley between the two lowest cañons. We were prepared, therefore, for the discovery of still more striking proof of the power and magnitude of the old glaciers, but never anticipated that so gigantic and perfect a piece of ice-work as the second cañon was in store for us. From a narrow gorge, the sides of which rise to heights of 1000 feet or more, the river darts out into the plain which we have been traversing. The rocky sides of this ravine are smoothly polished and striated from the bottom up apparently to the top. Some of the detached knobs of schist rising out of the plain at the mouth of the cañon were as fresh in their ice-polish as if the glacier had only recently retired from them. The scene reminded me more of the valley of the Aar above the Grimsel than of any other European glacier-ground. As we rode up the gorge with here and there just room to pass be-

tween the rushing river and the rocky declivity, we could trace the ice-worn bosses of schist far up the heights till they lost themselves among the pines. The frosts of winter are slowly effacing the surfaces sculptured by the vanished glacier. Huge angular blocks are from time to time detached from the crags and join the piles of detritus at the bottom. But where the ice-polished surfaces are not much traversed with joints they have a marvelous power of endurance. Hence they may have utterly disappeared from one part of a rock-face and remain perfectly preserved on another adjoining part. There could be no doubt now that the Yellowstone glacier was massive enough to fill up the second cañon to the brim, that is to say, it must have been there at least 800 or 1000 feet thick. But in the course of our ascent we obtained proof that the thickness was even greater than this, for we found that the ice had perched blocks of granite and gneiss on the sides of the volcanic hills not less than 1600 feet above the present plain of the river, and that it not merely filled up the main valley, but actually overrode the bounding hills so as to pass into some of the adjacent valleys. That glaciers once nestled in these mountains might have been readily anticipated, but it was important to be able to demonstrate their former existence, and to show that they attained such a magnitude.

The glaciers, however, were after all an unexpected or incidental kind of game. We were really on the trail of volcanic productions, and devoted most of our time to the hunt after them. The valley of the Yellowstone is of high antiquity. It has been excavated partly out of ancient crystalline rocks, partly out of later stratified formations, and partly out of masses of lava that have been erupted during a long succession of ages. Here and there it has been invaded by streams of basalt, which have subsequently been laboriously cut through by the river. In the whole course of our journey through the volcanic region we found that the oldest lavas were trachytes and their allies, while the youngest were as invariably basalts, the interval between the eruption of the two kinds having sometimes been long enough to permit the older rocks to be excavated into

gorges before the emission of the more recent. Even the youngest, however, must have been poured out a long while ago, for they, too, have been deeply trenched by the slow erosive power of running water. But the volcanic fires are not yet wholly extinguished in the region. No lava, indeed, is now emitted, but there are plentiful proofs of the great heat that still exists but a short way below the surface.

Quitting the moraine mounds of the Yellowstone Valley, which above the second cañon become still more abundant and perfect, we ascended the tributary known as Gardiner's River, and camped in view of the hot springs. The first glimpse of this singular scene, caught from the crest of a dividing ridge, recalls the termination of a glacier. A mass of snowy whiteness protrudes from a lateral pine-clad valley, and presents a steep front to the narrow plain at its base. The contrast between it and the somber hue of the pines all round heightens the resemblance of its form and aspect to a mass of ice. It is all solid rock, however, deposited by the hot water, which, issuing from innumerable openings down the valley, has in course of time filled it up with this white sinter. Columns of steam rising from the mass bore witness, even at a distance, to the nature of the locality. We wandered over this singular accumulation, each of us searching for a pool cool enough to be used as a bath. I found one where the water, after quitting its conduit, made a circuit round a basin of sinter, and in so doing cooled down sufficiently to let one sit in it. The top of the mound, and indeed those parts of the deposit generally from which the water has retreated, and which are therefore dry and exposed to the weather, are apt to crack into thin shells or to crumble into white powder. But along the steep front, from which most of the springs escape, the water collects into basins at many different levels. Each of these basins has the most exquisitely fretted rim. It is at their margins that evaporation proceeds most vigorously and deposition takes place most rapidly, hence the rim is being constantly added to. The colors of these wavy, frill-like borders are sometimes remarkably vivid. The sinter, where moist or fresh, has a delicate pink or salmon-

colored hue that deepens along the edge of each basin into rich yellows, browns, and reds. Where the water has trickled over the steep front from basin to basin, the sinter has assumed smooth curved forms like the sweep of unbroken waterfalls. At many points indeed, as one scrambles along that front, the idea of a series of frozen waterfalls rises in the mind. There are no eruptive springs or geysers at this locality now, though a large pillar of sinter on the plain below probably marks the site of one. Jack assured us that even since the time he had first been up here, some ten years before, the water had perceptibly diminished.

The contrast between the heat below and the cold above ground at nights was sometimes very great. We used to rise about daybreak and repair to the nearest brook or river for ablution. Sometimes a crust of ice would be found on the pools. One night, indeed, the thermometer fell to 19° , and my sponge, lying in its bag inside our tent, was solidly frozen so that I could have broken it with my hammer. The camping ground, selected where wood, water, and forage for the animals could be had together, was usually reached by about three o'clock in the afternoon, so that we had still several hours of daylight for sketching, or any exploration which the locality seemed to invite. About sunset Andy's fire had cooked our dinner, which we set out on the wooden box that held our cooking implements. Then came the camp-fire stories, of which our companions had a sufficient supply. Andy, in particular, would never be outdone. Nothing marvelous was told that he could not instantly cap with something more wonderful still that had happened in his own experience. What distances he had ridden! What hairbreadth escapes from Indians he had gone through! What marvels of nature he had seen! And all the while, as the tales went round and the fire burnt low or was wakened into fiercer blaze by piles of pine logs hewn down by Jack's diligent axe, the stars were coming out in the sky overhead. Such a canopy to sleep under! Wrapping myself round in my traveling cloak, I used to lie apart for a while, gazing up at that sky, so clear, so sparkling, so utterly and almost incredi-

bly different from the bleared, cloudy expanse we must usually be content with at home. Every familiar constellation had a brilliancy we never see through our moisture-laden atmosphere. It seemed to swim overhead, while behind and beyond it the heavens were aglow with stars that are hardly ever visible here at all. These quiet half-hours with the quiet stars, amid the silence of the primeval forest, are among the most delightful recollections of the journey.

Our mules were a constant source of amusement to us and of execration to Jack and Andy. Andy led the party, with his loaded rifle slung in front of his saddle ready for any service. After him came the string of mules with their packs, followed by Jack, who, with volleys of abuse and frequent applications of a leathern saddle-strap, endeavored to keep up their pace and preserve them in line. My friend and I varied our position, sometimes riding on ahead and having the pleasure of first starting any game that might be in our way, more frequently lingering behind to enjoy quietly some of the delicious glades in the forest. But we could never get far out of hearing of the whack of Jack's belt or the fierce whoop with which he would ever and anon charge the rearmost mules and send them scamp-ering on till every spoon, knife, and tin can in the boxes rattled and jingled. The proper packing of a mule is an art that requires considerable skill and practice, and Jack was a thorough master of the craft. After breakfast he used to collect the animals, while Andy made up the packs, and the two together proceeded to the packing. Such tugging and pulling and kicking on the part of men and mules! The quadrupeds, however, whatever their feelings might be, gave no vent to them. But the men found relief in such fusillades of swearing as I had never before heard or even imagined. I ventured one morning to ask whether the oaths were a help to them in the packing. Jack assured me that if I had them rules to pack he'd give me two days, and at the end of that he'd bet I'd swear myself worse than any of them. Another morning Andy was hanging his coat on a branch projecting near the camp fire. The coat, however, fell off the branch, and was, as a matter of course, greeted by its

owner with an execration. It was put up again, and again slipped down. This was repeated two or three times, and each time the language was getting fiercer and louder. At last, when the operation was successfully completed, I asked him of what use all the swearing at the coat had been. "Wall, boss," rejoined he triumphantly, "don't ye see the darned thing's stuck up now?" This I felt was, under the circumstances, an unanswerable argument. Western teamsters are renowned for their powers of continuous execration. I myself heard one swear uninterruptedly for about ten minutes at a man who was not present, but who it seemed was doomed to the most horrible destruction, body and soul, as soon as this bloodthirsty ruffian caught sight of him again, either in this world or the next.

From Gardiner's River we made a *détour* over a long ridge dotted with ice-borne blocks of granite and gneiss, and crossed the shoulder of Mount Washburne by a col 8,867 feet above the sea, descending once more to the Yellowstone River at the head of the Grand Cañon. The whole of this region consists of volcanic rocks, chiefly trachytes, rhyolites, obsidians, and tuffs. We chose as our camping ground a knoll under a clump of tall pines, with a streamlet of fresh water flowing below it in haste to join the main river, which, though out of sight, was audible in the hoarse thunder of its falls. Impatient to see this ravine, of whose marvels we had heard much, we left the mules rolling, on the ground and our packers getting the camp into shape, and struck through the forest in the direction of the roar. Unprepared for anything so vast, we emerged from the last fringe of the woods and stood on the brink of the great chasm, silent with amazement.

The Grand Cañon of the Yellowstone is a ravine from 1000 to 1500 feet deep. Where its shelving sides meet at the bottom, there is little more than room for the river to flow between them, but it widens irregularly upward. It has been excavated out of a series of volcanic rocks by the flow of the river itself. The waterfalls, of which there are here two, have crept backward, gradually eating their way out of the lavas and leaving below them the ravine of the Grand Cañon. The weather has

acted on the sides of the gorge, scarping some parts into precipitous crags, and scooping others back, so that each side presents a series of projecting bastions and semicircular sloping recesses. The dark forests of pine that fill the valley above sweep down to the very brink of the gorge on both sides. Such is the general plan of the place; but it is hardly possible to convey in words a picture of the impressive grandeur of the scene.

We spent a long day sketching and wandering by the side of the cañon. Scrambling to the edge of one of the bastions and looking down, we could see the river far below, dwarfed to a mere silver thread. From this abyss the crags and slopes towered up in endless variety of form, and with the weirdest mingling of colors. Much of the rock, especially of the more crumbling slopes, was of a pale sulphur yellow. Through this groundwork harder masses of dull scarlet, merging into purple and crimson, rose into craggy knobs and pinnacles, or shot up in sheer vertical walls. In the sunlight of the morning the place is a blaze of strange color, such as one can hardly see anywhere save in the crater of an active volcano. But as the day wanes, the shades of evening sinking gently into the depths blend their livid tints into a strange mysterious gloom, through which one can still see the white gleam of the rushing river and hear the distant murmur of its flow. Now is the time to see the full majesty of the cañon. Perched on an outstanding crag one can look down the ravine and mark headland behind headland mounting out of the gathering shadows and catching up on their scarred fronts of yellow and red the mellow tints of the sinking sun. And above all lie the dark folds of pine sweeping along the crests of the precipices, which they crown with a rim of somber green. There are gorges of far more imposing magnitude in the Colorado Basin, but for dimensions large enough to be profoundly striking, yet not too vast to be taken in by the eye at once, for infinite changes of picturesque detail, and for brilliancy and endless variety of coloring, there are probably few scenes in the world more impressive than the Grand Cañon of the Yellowstone. Such at least were the feelings with which we reluctantly left it to resume our journey.

The next goal for which we made was the Geyser Basin of the Firehole River—a ride of two days, chiefly through forest, but partly over bare volcanic hills. Some portions of this ride led into open park-like glades in the forest, where it seemed as if no human foot had ever preceded us; not a trail of any kind was to be seen. Here and there, however, we noticed footprints of bears, and some of the trees had their bark plentifully scratched, at a height of three or four feet from the ground, where, as Jack said, "the bears had been sharpening their claws." Deer of different kinds were not uncommon, and we shot enough to supply our diminishing larder. Now and then we came upon a skunk or a badger, and at night we could hear the mingled bark and howl of the wolves. Andy's rifle was always ready, and he blazed away at everything. As he rode at the head of the party the first intimation those behind had of any game afoot was the crack of his rifle, followed by the immediate stampede of the mules, and a round of execration from Jack. I do not remember that he ever shot anything save one wild duck, which immediately sank, or at least could not be found.

Reaching at length the Upper Geyser Basin, we camped by the river in the only group of trees in the immediate neighborhood that had not been invaded by the sheets of white sinter which spread out all round on both sides of the river. There were hot springs, and spouting geysers, and steaming caldrons of boiling water in every direction. We had passed many openings by the way whence steam issued. In fact in some parts of the route we seemed to be riding over a mere crust between the air above and a huge boiling vat below. At one place the hind foot of one of the horses went through this crust, and a day or two afterward, repassing the spot, we saw it steaming. But we had come upon no actual eruptive geyser. In this basin, however, there is one geyser which, ever since the discovery of the region some ten years ago, has been remarkably regular in its action. It has an eruption once every hour or a few minutes more. The kindly name of "Old Faithful" has accordingly been bestowed upon it. We at once betook ourselves to this vent. It stands upon a low mound of sinter, which, seen from a

little distance, looks as if built up of successive sheets piled one upon another. The stratified appearance, however, is due to the same tendency to form basins so marked at the Hot Springs on Gardiner's River. These basins are bordered with the same banded, brightly colored rims which, running in level lines, give the stratified look to the mound. On the top the sinter has gathered into huge dome-shaped or coral-like lumps, among which lies the vent of the geyser—a hole not more than a couple of feet or so in diameter—whence steam constantly issues. When we arrived a considerable agitation was perceptible. The water was surging up and down a short distance below, and when we could not see it for the cloud of vapor its gurgling noise remained distinctly audible. We had not long to wait before the water began to be jerked out in occasional spurts. Then suddenly, with a tremendous roar, a column of mingled water and steam rushed up for 120 feet into the air, falling in a torrent over the mound, the surface of which now streamed with water, while its strange volcanic colors glowed vividly in the sunlight. A copious stream of still steaming water rushed off by the nearest channels to the river. The whole eruption did not last longer than about five minutes, after which the water sank in the funnel, and the same restless gurgitation was resumed. Again at the usual interval another eructation of the same kind and intensity took place.

Though the most frequent and regular in its movements, "Old Faithful" is by no means the most imposing of the geysers either in the volume of its discharge or in the height to which it erupts. The "Giant" and "Beehive" both surpass it, but are fitful in their action, intervals of several days occurring between successive explosions. Both of them remained tantalizingly quiet, nor could they be provoked, by throwing stones down their throats, to do anything for our amusement. The "Castle Geyser," however, was more accommodating. It presented us with a magnificent eruption. A far larger body of water than at "Old Faithful" was hurled into the air, and continued to rise for more than double the time. It was interesting to watch the rocket-like projectiles of water and steam that shot

through and out of the main column, and burst into a shower of drops outside. At intervals, as the energy of discharge oscillated, the column would sink a little, and then would mount up again as high as before, with a hiss and roar that must have been audible all round the geyser basin, while the ground near the geyser perceptibly trembled. I had been sketching close to the spot when the eruption began, and in three minutes the place where I had been sitting was the bed of a rapid torrent of hot water rushing over the sinter floor to the river.

Without wearying the reader with details that possess interest only for geologists, I may be allowed to refer to one part of the structure of these geyser mounds which is not a little curious and puzzling—the want of sympathy between closely adjacent vents. At the summit of a mound the top of the subterranean column of boiling water can be seen about a yard from the surface in a constant state of commotion, while at the base of the mound, at a level thirty or forty feet lower, lie quiet pools of steaming water, some of them with a point of ebullition in their center. There can be no direct connection between these pipes. Their independence is still more strikingly displayed at the time of eruption, for while the geyser is spouting high into the air, these surrounding pools go on quietly boiling as before. It is now generally acknowledged that the seat of eruptive energy is in the underground pipe itself, each geyser having its peculiarities of shape, depth, and temperature. But it would appear also that at least above this seat of activity there may be no communication even between contiguous vents on the same geyser mound.

Another interesting feature of the locality is the tendency of each geyser to build up a cylinder of sinter round its vent. A few of these are quite perfect, but in most cases they are more or less broken down as if they had been blown out by occasional explosions of exceptional severity. Usually there is only one cylindrical excrescence on a sinter mound; but in some cases several may be seen with their bases almost touching each other. As the force of the geyser diminishes and its eruptions become less frequent the funnel seems to get choked up with sinter,

until in the end the hollow cylinder becomes a more or less solid pillar. Numerous eminences of this kind are to be seen throughout the region. Their surfaces are white and crumbling. They look, in fact, so like pillars of salt that one could not help thinking of Lot's wife, and wondering whether such geyser columns could ever have existed on the plains of Sodom. In a rainless climate they might last a long time. But the sinter here, as at Gardiner's River, when no longer growing by fresh deposits from the escaping water, breaks up into thin plates. Those parts of the basin where this disintegration is in progress look as if they had been strewn with pounded oyster-shells.

That the position of the vents slowly changes is indicated on the one hand by the way in which trees are spreading from the surrounding forest over the crumbling floor of sinter, and on the other by the number of dead or dying trunks which here and there rise out of the sinter. The volcanic energy is undoubtedly dying out. Yet it remains still vigorous enough to impress the mind with a sense of the potency of subterranean heat. From the upper end of the basin the eye ranges round a wide area of bare sinter plains and mounds, with dozens of columns of steam rising on all sides; while even from among the woods beyond an occasional puff of white vapor reveals the presence of active vents in the neighboring valley. A prodigious mass of sinter has, in the course of ages, been laid down, and the form of the ground has been thereby materially changed. We made some short excursions into the forest, and as far as we penetrated the same floor of sinter was everywhere traceable. Here and there a long extinct geyser mound was nearly concealed under a covering of vegetation, so that it resembled a gigantic ant-hill; or a few steaming holes about its sides or summit would bring before us some of the latest stages in geyser history.

One of the most singular sights of this interesting region are the mud volcanoes, or mud geysers. We visited one of the best of them, to which Jack gave the name of "The Devil's Paint-pot." It lies near the margin of the Lower Geyser basin. We approached it from below, surmounting by the way a series of

sinter mounds dotted with numerous vents filled with boiling water. It may be described as a huge vat of boiling and variously colored mud, about thirty yards in diameter. At one side the ebullition was violent, and the grayish-white mud danced up into spurts that were jerked a foot or two into the air. At the other side, however, the movement was much less vigorous. The mud there rose slowly into blister-like expansions, a foot or more in diameter, which gradually swelled up till they burst, and a little of the mud with some steam was tossed up, after which the bubble sank down and disappeared. But nearer the edge on this pasty side of the caldron the mud appeared to become more viscous, as well as more brightly colored green and red, so that the blisters when formed remained, and were even enlarged by expansion from within, and the ejection of more liquid mud over their sides. Each of these little cones was in fact a miniature volcano with its circular crater atop. Many of them were not more than a foot high. Had it been possible to transport one unbroken, we could easily have removed it entire from its platform of hardened mud. It would have been something to boast of, that we had brought home a volcano. But, besides our invincible abhorrence of the vandalism that would in any way disturb these natural productions, in our light marching order, the specimen, even had we been barbarous enough to remove it, would soon have been reduced to the condition to which the jolting of the mules had brought our biscuits—that of fine powder. We remained for hours watching the formation of these little volcanoes, and thinking of Leopold von Buch and the old exploded “crater of elevation” theory. Each of these cones was, nevertheless, undoubtedly a true crater of elevation.

Willingly would we have lingered longer in this weird district. But there still lay a long journey before us ere we again could reach the confines of civilization; we had, therefore, to resume the march. The Firehole River, which flows through the Geyser Basins, and whose banks are in many places vaporous heaps of sinter, the very water of the river steaming as it flows along, is the infant Madison River, which we had crossed early in the journey far down below its lowest cañon on our way to Fort

Ellis. Our route now lay through its upper cañon, a densely-timbered gorge with picturesque volcanic peaks mounting up here and there on either side far above the pines. Below this defile the valley opens out into a little basin, filled with forest to the brim, and then, as usual, contracts again toward the opening of the next cañon. We forded the river, and, mounting the ridges on its left side, looked over many square miles of undulating pine-tops,—a vast dark-green sea of foliage stretching almost up to the summits of the far mountains. At last, ascending a short narrow valley full of beaver dams, we reached a low flat water-shed 7,063 feet above the sea, and stood on the "great divide" of the continent. The streams by which we had hitherto been wandering all ultimately find their way into the Missouri and the Gulf of Mexico; but the brooks we now encountered were some of the infant tributaries of the Snake or Columbia River, which drains into the Pacific. Making our way across to Henry's Fork, one of the feeders of the Snake River, we descended its course for a time. It led us now through open moor-like spaces, and then into seemingly impenetrable forest. For some time the sky toward the west had been growing more hazy as we approached, and we now found out the cause. The forest was on fire in several places. At one part of the journey we had just room to pass between the blazing crackling trunks and the edge of the river. For easier passage we forded the stream, and proceeded down its left bank, but found that here and there the fire had crossed even to that side. Most of these forest fires result from the grossest carelessness. Jack was particularly cautious each morning to see that every ember of our camp-fire was extinguished, and that by no chance could the dry grass around be kindled, for it might smolder on and slowly spread for days, until it eventually set the nearest timber in a blaze. We used to soak the ground with water before resuming our march. These forest fires were of course an indication that human beings, either red or white, had been on the ground not long before us. But we did not come on their trail. One morning, however—it was the last day of this long march—we had been about a couple of hours in the saddle. The usual

halt had been made to tighten the packs, and we were picking our way across a dreary plain of sage brush on the edge of the great basalt flood of Idaho, when Jack, whose eyes were like a hawk's for quickness, detected a cloud of dust far to the south on the horizon. We halted, and in a few minutes Jack informed us that it was a party of horsemen, and that they must be Indians from their way of riding. As they came nearer we made out that there were four mounted Indians with four led horses. Jack dismounted and got his rifle ready. Andy, without saying a word, did the same. They covered with their pieces the foremost rider, who now spurred on rapidly in front of the rest, gesticulating to us with a rod or whip he carried in his hand. "They are friendly," remarked Jack, and down went the rifles. The first rider came up to us, and after a palaver with Jack, in which we caught here and there a word of broken English, we learned that they were bound for a council of Indians up in Montana.

Four more picturesque savages could not have been desired to complete our reminiscences of the Far West. Every bright color was to be found somewhere in their costumes. One wore a bright blue coat faced with scarlet, another had chosen his cloth of the tawniest orange. Their straw hats were encircled with a band of down, and surmounted with feathers. Scarlet braid embroidered with beads wound in and out all over their dress. Their rifles (for every one of them was fully armed) were cased in richly brodered canvas covers, and were slung across the front of their saddles, ready for any emergency. One of them, the son of a chief whose father Jack had known, carried a twopenny looking-glass hanging at his saddle-bow. We were glad to have seen the noble savage in his war-paint among his native wilds. Our satisfaction, however, would have been less had we known then what we only discovered when we got down into Utah, that a neighboring tribe of the Utes were in revolt, that they had murdered the agent and his people, and killed a United States officer and a number of his soldiers, who had been sent to suppress the rising, and that there were rumors of the disaffection spreading into other tribes. We saluted our stran-

gers with the Indian greeting, "How!" whereupon they gravely rode round and formally shook hands with each of us. Jack, however, had no faith in Indians, and after they had left us, and were scampering along the prairie in a bee-line due north, he still kept his eye on them till they entered a valley among the mountains, and were lost to sight. In half an hour afterward another much larger cloud of dust crossed the mouth of a narrow valley down which we were moving. Waiting a little unperceived to give the party time to widen their distance from us, we were soon once more upon the great basalt plain.

The last section of our ride proved to be in a geological sense one of the most interesting parts of the whole journey. We found that the older trachytic lavas of the hills had been deeply trenched by lateral valleys, and that all these valleys had a floor of the black basalt that had been poured out as the last of the molten materials from the now extinct volcanoes. There were no visible cones or vents from which these floods of basalt could have proceeded. We rode for hours by the margin of a vast plain of basalt, stretching southward and westward as far as the eye could reach. It seemed as if the plain had been once a great lake or sea of molten rock which surged along the base of the hills, entering every valley, and leaving there a solid floor of bare black stone. We camped on this basalt plain near some springs of clear cold water which rise close to its edge. Wandering over the bare hummocks of rock, on many of which not a vestige of vegetation had yet taken root, I realized with vividness the truth of an assertion made first by Richthofen, but very generally neglected by geologists, that our modern volcanoes, such as Vesuvius or Etna, present us with by no means the grandest type of volcanic action, but rather belong to a time of failing activity. There have been periods of tremendous volcanic energy, when, instead of escaping from a local vent, like a Vesuvian cone, the lava has found its way to the surface by innumerable fissures opened for it in the solid crust of the globe over thousands of square miles. I felt that the structure of this and the other volcanic plains of the Far West furnish the true key to the history of the basaltic plateaux of Ireland

and Scotland, which had been an enigma to me for many years.

At last we reached the railway that had been opened only a week or two before. Andy rode on ahead to the terminus, to intimate that we wished to be picked up. In a short while the train came up, and as we sat there in the bare valley near no station, the engine slowed at sight of us. Our two companions were now to turn back and take a shorter route to Fort Ellis, but would be at least ten days on the march. We parted from them not without regret. Rough, but kindly, they had done everything to make the journey a memorably pleasant one to us. We took our seats in the car, and from the window, as we moved away, caught the last glimpse of our cavalcade, Andy in front with a riderless horse, and Jack in the rear with another.

ARCHIBALD GEIKIE, F.R.S., in *Macmillan's Magazine*.

YOUNG MRS. CARLYLE.

A LIFE STUDY.

There is not a greater want, perhaps, in the whole range of modern literature than that of some vivid portraiture of nineteenth-century womanhood, as finely drawn, and from as fine a model, as those biographies of Charles Kingsley or of Dr. Arnold, which are now among the classics of the English tongue. We look in vain for any like record of a woman's life—lofty, simple, and complete; one which may be taken as a daily guide and inspiration by the many who would willingly shape their own into some benignant noble form, could they but see exactly how to do it, or even what there was for them to do. The lives themselves are lived among us, in all their quiet sweet reality. It is the story of them only which is waiting to be told. Not that biographies of noteworthy women are altogether wanting; but admirable as some of them are, Mrs. Gaskell's life of Charlotte Brontë, for example, their interest centers rather in points of genius or circumstance which lie

apart from the ordinary life of womanhood, than in that web of duties, cares, and joys, which may be said to be womanhood itself. What we need, and what these biographies fail to give us, is the every-day ideal, the perfect pattern, traced by some fine unerring hand, on just such another homespun fabric as we ourselves, the vast majority of us at least, must be content to work on too.

It would be too much to say that Mr. Carlyle's *Reminiscences* of his wife, which occupy the larger part of one of the volumes lately edited by Mr. Froude, fulfill all the requirements of such a biography. They do more to show the lines on which it should be written, and to fill the gap in our literature which the absence of it causes, than anything else which we could name; but they are too brief, too fragmentary, and written from a point of view too exclusively his own, to be in their present form more than the mere sketch, as it were, of what the finished work should be. The homespun web is there, and the perfect pattern, too; but the latter is seen in outline only. The filling-in, the full impression of herself we must wait for until Mrs. Carlyle, to use Mr. Froude's expression, becomes her own biographer, and through her letters, which in large numbers are forthcoming, shall complete the task her husband has begun.

Meanwhile in these *Reminiscences* we have received a gift whose value, were its full significance perceived, it would be hard to overrate. Defects and flaws, no doubt, there are, blemishes which disturb and offend us too. Especially we must regret that, written as they were when Carlyle's own life seemed wrenched and worthless to him, they should give us his impressions of some of his contemporaries diminished to the same scale which he applied in all sincerity and humility to himself. It is when his eyes are fixed on the home ideal that things resume their true proportions, and the wisdom of his ripest years, with tenderness such as only the strong can feel, embody themselves in his picture of the perfect wife. Except in the Hebrew Scriptures there is nothing, perhaps, accessible to English readers, so homely, pathetic, beautiful, and solemn too, as these records of the twofold life which, for forty years, Carlyle

and his wife lived side by side together. To read them is like entering a temple, the sanctuary of a human soul, in which we walk with bowed head, awed by its sanctities of sorrow and of love.

"I wrote that book out of my very heart," said the author of "*Sartor Resartus*" once; but this book is his heart itself. Its closing words, full of profoundest pathos, reveal, as not the most labored praise could do, how complete in all womanly perfectness must have been the life which so long had companioned with his own, how tender and entire the relation that had subsisted between the two. "It has been my sacred shrine," he says of the note-book belonging to his wife, in which these memories of her were written—"my sacred shrine, and religious city of refuge from the bitterness of these sorrows, during all the doleful weeks that are past since I took it up; a kind of devotional thing (as I once already said) which softens all grief into tenderness and infinite pity and repentant love, one's whole sad life drowned as if in tears for one, and all the wrath and scorn and other grim elements silently melted away. And now, am I to leave it; to take farewell of her a second time? Right silent and serene is she, my lost darling yonder, as I often think in my gloom, no sorrow more for her, nor will there long be for me."

It might be worth our while to learn the secret of such a life; to find, were it possible to do so, how it is that, in these latter decades of the nineteenth century, it impresses us, as we read the record of it here, like some piece of antique statuary, graceful, majestic, and yet so simply natural that it might stand as a model for countless others of the same type outwardly as its own. For we must bear in mind, indeed the value of these memorials consists largely in the fact, that so far as mere outward circumstances went, Mrs. Carlyle's life differed little from that of most other women of her own rank and time. She was the wife of a distinguished man, it is true; though when she married him he was obscure enough, and poor for years afterwards; but for the rest, they lived and kept house together in a simple, homely, and altogether ordinary fashion. Any claim to distinction which she herself possessed rested mainly on that

royalty of womanhood which the merest peasant may emulate, and which the queens of society too often lack. From the age of five-and-twenty, when she married Mr. Carlyle, her place in the world may be best defined by those two old-fashioned words, now fallen almost into desuetude, "housewife" and "helpmeet"—the helpmeet of a husband who more than most men needed such help as she supplied—the modest queen of a frugal home. This was the part which, for forty years, she was content to play. To perform it perfectly was the task she set herself, and with all her might accomplished. How she achieved it, and how successfully; with what fine alchemy she turned the dross of life into its gold, and made its sorriest prose take the measure of a song; and how, in the simple character of wife at home, she made her life yield for the world's good a harvest of rich increase, may be gathered from these brief but graphic records, which every woman who has a home to guide, or a life other than her own to share, may study to advantage.

Jane Welsh Carlyle was the only child of a Scotch country physician in large practice. The atmosphere of the home in which she grew up was one of opulence, culture, thrift, and thoroughness. The strongest influence in the shaping of her character was that of her father, whom she idolized; a man in whose nature the sense of honor was deeply rooted, gentle, valiant, and with much capacity and directness of purpose. He died when his young daughter was standing just on the threshold of womanhood—"Her first, and in all her life her greatest grief." Three years later Thomas Carlyle, then making a scanty living by taking pupils in Edinburgh, was brought by his friend Irving to the house at Haddington where the girl and her mother still lived on. Not long afterwards we find the two apparently engaged, and at twenty-five she married. From Edinburgh, where they began housekeeping, the pair presently removed to Craigenputtoch, a small moorland farm, which formed part of the dowry brought by Mrs. Carlyle to her husband. Here seven frugal, lonely, toilsome years were passed. Then to London, the fight with poverty not ended yet by ten good years or more; and in the house at Cheyne Row, to which

they went on their arrival, husband and wife remained till death stepped in between them, and the "fair companionship" was broken up.

Such, in brief outline, is the story of her life. Simpler it could hardly be. We have glimpses of a sunny childhood, and of the sheltered home in which the girl grew up. She was a dark-eyed maiden of twenty-two when Carlyle first saw her; handsome, high-spirited, much admired and sought after, and, seemingly, not averse to the homage she received. The lot of womanhood was before her, and no lack of opportunities for securing what, in modern phrase, is understood as "a good establishment." The girl had views of her own, however, as to what a good establishment consisted in. The right womanly nature within her sought out for what every woman who is worthy of the name does seek and care for in the man who is to complete and share her whole life on earth. It was herself she had to bestow in marriage, and she wanted value in return; not the outward accidents of fortune and position, the mere shell and husk of a man, but that inward having of strength and tenderness, that kingliness based on the will to serve, as well as on the power to rule, which alone can make the obedience of a wife honorable and joyful too. It says much for her insight that, in the guise of this poor scholar, dyspeptic, gauche, and humbly born, she saw the greatest man who had yet addressed her; and not a little for her wisdom that she chose rather to share his lot, hard as it was then, than to give herself into the keeping of some richer but otherwise more scantily gifted suitor. Dr. Welsh, with a somewhat rare confidence in his daughter's discretion, had left the whole of his property, as it seems, unreservedly at her disposal. Half of it was sacredly set apart by her for her mother's use; the other half, about a hundred a year or so, she turned to perhaps the best account that a woman in her position could. She secured with it the power to marry a poor man; too poor at that time to support himself and a wife as well, but the best and wisest man she knew, the one her heart had chosen, and whose helpmeet, for highest and for homeliest ends, she was ready to become.

A true marriage that! true to the inmost meaning of that most solemn bond. Fruitful in blessing too, to herself and to the world. Even according to the mere verdict of society, few would say now, whatever they might do then, that the wife of Thomas Carlyle had thrown herself away; and who, reading these Reminiscences, but must feel that the woman who had been loved from youth to old age with such fidelity and tenderness had had her share of the best joys a wife can know?

What discouragement there may have been from without we are not here told. From one passage, referring to the "triumph" of the Inaugural Address at Edinburgh, delivered by Mr. Carlyle just before his wife's death, we may conclude, however, that the opposition of well-meaning friends was not wanting, and that in making so poor a match the brave "Jeannie" was guided by her own courage and insight mainly. "Noble little heart! her painful, much enduring, much endeavoring little history, now at last crowned with plain victory in sight of her own people, and of all the world; every one now obliged to say my Jeannie was not wrong; she was right, and has made it good. Surely for this I should be grateful to heaven—for this amidst the immeasurable wreck that was preparing for us. She had from an early period formed her own little opinion about me (what an Eldorado to me, ungrateful being; blind, ungrateful, condemnable, and heavy-laden, and crushed down into blindness by great misery, as I oftenest was!), and she never flinched from it an instant, I think; or cared, or counted, what the world said to the contrary; but to have the world confirm her in it was always a sensible pleasure, which she took no pains to hide, especially from me."

More than at first sight appears depended, perhaps, on what that "opinion" was. Whatever the world may owe to the writings of Thomas Carlyle, it probably owes in great measure to the sagacity and devotion of the girl who in becoming his wife, and his "helpmeet" in the fullest sense, made it possible for him to struggle on through the mud swamps of literature until he had secured firm foothold of his own. If Jeannie Welsh had been less nobly minded than she was, if she had not deliberately

chosen to follow that which was highest in her nature, highest also in her life, she might have been the wife of some richer man, but "Sartor Resartus" and "Cromwell" would probably have remained unwritten.

Still, if it was a courageous, it was not an imprudent marriage. The young Scotch gentlewoman, with her house of life to be builded up, looked well to its foundations first. She had sagacity enough to perceive that, sooner or later, the world must listen to what the poor scholar had to say; but even if delay were long, they would have enough between them, with thrifty management, with industry on her part and on his, to keep poverty from the door; enough for content, and for homely comfort too. There is not a more beautiful picture of real life, if we look at it well, in any writing of this century, or one which better illustrates some of the essential elements in noble feminine work, than that which Mr. Carlyle draws of their life at Craigenputtoch, the moorland farm above referred to, whither the two went soon after their marriage.

"The saving charm of her life there," he says, "which to another young lady of her years might have been so gloomy and vacant, was that of conquering the innumerable practical problems which had arisen for her there: all of which—I think all—she triumphantly mastered. . . . Perfection of housekeeping was her speedy attainment in that new scene. Strange how she made the desert blossom for herself and me there! What a fairy palace she had made of that wild moorland home of the poor man! In my life I have seen no human intelligence that so genuinely pervaded every fiber of the human existence it belonged to. From the baking of a loaf or the darning of a stocking up to comporting herself in the highest scenes or most intricate emergencies, all was insight, veracity, graceful success (if you could judge it), fidelity to insight of the fact given."

"Perfection in housekeeping." The young Mrs. Carlyle had mastered other things before she tried her hand at that. In those earlier Craigenputtoch days the two read together of evenings "*Don Quixote*" in the original. Tasso in like manner had preceded it. Latin we know that she began to teach herself

when a little girl, and had now a scholarly acquaintance with. Clearly the "higher education" had been carried on in her case to an extent not altogether common even in these days of Girton and Newnham and women wranglers. She was accomplished too—could charm her guests by her singing of Scotch songs, and had at command the wit and grace and gayety which make a woman fascinating in society. The great Lord Jeffrey himself—and he was no mean critic in other fields beside those of literature—had been her assiduous admirer ever since his discovery in Edinburgh of the bonny bride; and with a touch of mournful complacency Mr. Carlyle tells us how deftly, when she chose, she could wield the woman's scepter in the brilliant coteries there. That bleak moorland homestead, "sixteen miles from anywhere," offered no facilities for queening it in society. The young wife queened it in another way—conquered her woman's kingdom there down to its last inch of territory. Like the daughter of many an excellent manager, she had not been trained by her mother to any practical acquaintance with the domestic arts. The whole field of housewifery was a terra incognita to her, and on good housewifery her husband's comfort and health and power to work depended. That was motive enough for her; that dignified the meanest details, and made her find a charm in all she did. Just as she had set herself when a child to learn Latin, so she set herself now to learn and to practise all that belonged to the many-sided ministry of a wife, its material as well as its spiritual part. Cervantes or Tasso might be a pleasant diversion to the tired thinker who had all day long been earning his bread in the sweat of his brain and of his heart; but for a dyspeptic workman the bread itself must be of perfect quality, and bakers and servants did not make it so. Good brainwork—so curiously is thinking man compounded—depends so much on good digestion, and this again on wholesome fare, of which one prime requisite is honest, well-made bread, such as it is the part of a true housewife to provide. The young lady who could master "Don Quixote" in the original was likely, in default of other sources of supply, to be able to make good bread herself if she

gave her mind to it, and Mrs. Carlyle did give her mind to it. There is a world of meaning in the story told us of the making of her first brown loaf, of her doubts as to the result, and how she sat down by the oven door, "like Cellini with his Perseus," after she had put it in to bake. The essence of true womanhood—of true ladyhood was there, homely as the incident to unpurged eyes may seem. She had her reward too. The loaf came out all that a loaf ought to be—crusty, and light, and sweet; "and from that hour," says the chronicler; "we never wanted excellent bread." One corner of her domain, and that no unimportant one either, was conquered, and she had earned the right to bear in her household the good old Saxon title, far gone now from its original meaning, "Lady;" the laaf-dig, loaf-giver.

So throughout. She bent her whole faculty to doing the duty that lay nearest to her, and to seeing what that duty was. She put her life into it, and she found her joy in it, joy such as a rich man's wife can scarcely know. There is a radiance of glad activity about the whole of that Craigenputtoch life, of simplicity and refinement, of graceful hospitality, and of outreaching kindness as well. We read, for example, of her walking two miles night and morning for ten days or so to make the bed of "Old Esther," a poor cottager who lay a-dying at some little distance from their home. She took up the ends and thrums of a life that might have been dull and commonplace, and almost mean in other hands, and wove her perfect pattern out of them; a pattern which every woman may copy, and in its spiritual part every gentlewoman too.

After seven years at Craigenputtoch, the Carlyles migrated to London; and here the same womanly faculty in the wife soon made "a little Eden round her," of the small three-story house which they had chosen for their home, "so neat and graceful in its simplicity and thrifty poverty;" a soft entourage for nerves fretted and jaded by the strain of thought, as her husband's mostly were. She took things just as they were, here as she had done in their rude moorland home, and without more ado cheerfully and skillfully made the best of them. One great

secret, that, of a successful life, more especially the life of a woman, whose part, as Xenophon in his "Economist" long ago pointed out, is to arrange and combine what material comes to her hand, rather than to choose what that material shall be. It was this faculty of making the best of things as they were, seeing them in sunshine and making others see them so as well, which gave its charm and radiance to her home life; just as her steadfast resolve to have nothing to do with "Shams," or the vulgar toil of "keeping up appearances," gave it dignity and repose. Reality was the basis of her life, the atmosphere in which she breathed. Perhaps, if we look into it well, it was this superiority to all pretense which, more than any other quality, marked the difference between her and less noteworthy women. Fine reserves there were, as in all graceful lives there must be, though these were of her own disquietudes and sufferings mainly; but whatever might be gently veiled away, all that was seen was precisely what it appeared to be, courage, simplicity, truth to fact. From the highest down to the humblest matters of her life this genuineness pervaded it, redeeming it from every vestige of commonplaceness, and giving it a certain nobility and ease which the lives of many women quite needlessly lack.

We must refer the reader to the *Reminiscences* themselves for any just impression of what Mrs. Carlyle was in her higher ministry as wife to a man burdened and sore bestead from within and from without, as Thomas Carlyle through life for the most part was. To understand her in this aspect we must understand him too, as in this remarkable piece of duo-biography he reveals himself to us. "Could I be easy to live with?" he asks with candid pathos; and we have to own that "skinless mortal" as he was, "so terribly in earnest" too, and the writing of his books such grim and ceaseless taskwork to him, he probably was not.

But this problem too, the hardest perhaps of all, she mastered, as she had done the others, in the only way that such a problem can be mastered, by seeking her husband's good unweariedly and making it her own. Mr. Carlyle was not perfect. No man is. Sound as heart of oak within, he was as gnarled

and rugged on the surface as any giant of the glade. His wife did not "worry" over his defects, but softly adapted herself to them, shone round him with a light radiance of hope in his moods of perverse humility, or soothed his fretted and stubborn pride. "My noble one! I say deliberately, her part in the stern battle, and except myself none knows how stern, was brighter and braver than my own." "Oh, her love to me; her cheering, unaffected, useful practicality of help! Was I not rich after all? She had a steady hope in me, too, while I myself had habitually none (except of the desperate kind); nay, a steady contentment with me, and with our lot together, let hope be as it might."

One sees shining through all this, not the vulgar ideal of "happiness," i.e., the lust of the flesh, the lust of the eye, and the pride of life, satisfied to their full extent; but the "blessedness," better still, the best a woman can aspire to or attain, of being to another what Carlyle says his wife was to him, "a nobler second self." From first to last this higher, spirit-serving ministry was hers, as well as the lowlier one to homely needs; dignifying the latter, and giving to her life a meaning and unity, a far-reaching significance, which as that of the mere admirable house-wife it would have missed. Carlyle's own words about the little chair which in his will he couples with his writing-table as the most precious of his possessions, will best show what this higher service had been to him. "Her little bit of a first chair, its wee wee arms, etc., visible to me in the closet at this moment, is still here, and always was. I have looked at it hundreds of times; from of old, with many thoughts. No daughter or son of hers was to sit there; so it had been appointed us, my darling. I have no book a thousandth part so beautiful as thou; but these were our only 'children,' and, in a true sense, these were verily ours; and will perhaps live some time in the world after we both are gone. The will of the Supreme shall be accomplished. Amen."

After all, however, as we said above, there was nothing extraordinary or out of reach in the career or character of Mrs. Carlyle. The simple every-day life of a wife at home was that on/

which she entered at her marriage, and its quiet course she kept until the end. If on other grounds these Reminiscences are full of profound pathetic interest, not their least value lies in their being the record of one of those simple, noble, and truly feminine lives, which seem to say to all who witness them, to every woman at least, "Go thou and do likewise."

By MARY C. TABER, in Good Words.

MODERN SPANISH LITERATURE.

There are several contemporary Spanish writers who seem to be little known in England, and of whose works readers of the Academy may be glad to have a brief indication.

First among living poets of Spain stands Nufiez de Arce. Neither his new poem, "Herman el Lobo," of which he read one canto some months ago before the Ateneo of Madrid, nor the collected edition of his other works, have yet appeared. Nufiez de Arce is not a poet who dwells apart from actual life in the regions of the ideal. His art is far from being passionless or impersonal. His muse is essentially that of a patriot, and his heart throbs in unison with every political, social, or religious movement of his age. His verses in "Gritos del Combate" (third edition, 1875) reflect to the full the painful feelings of every true Spaniard at the various crises of his country's fate from 1868-73. Ever he points to a higher morality as the sole means of the regeneration of his country. His sonnet "España" is a noble protest against the national corruption. His little poem "Excelsior" may be favorably compared with that of Longfellow. In point of art, the finest of all these early poems is the longest, "Raimundo Lulli." With greater earnestness, and with deeper philosophical insight, it recalls Tennyson's "Palace of Art." Since this volume, only separate poems have appeared, of which the two most interesting to Englishmen are "La Última Lamentacion de Lord Byron" (fifteenth

edition, 1881), and "La Vision de Fray Martin" (seventh edition, 1880), which treats of the revolt of Luther from a Roman Catholic, but highly poetical, point of view. The dramatical works of Nuñez de Arce have been collected in one volume, but in this form of verse he is hardly so successful as in lyrical and narrative poetry.

Of living novelists we give decidedly the first place to Juan Valera, a critic, poet, and dramatist, as well as novel-writer. In lighter lyrical drama, and in zarzuelas, he is very successful; but, as a critic, he falls far short of our expectation. In the Prefaces to his novels he complains of want of popularity. His audience, though fit, is but few. Valera is essentially a man's novelist. He excels in analysis of character. His canvas is never crowded. He works up all his novels to a single incident, which throws sudden and unexpected light, not so much on the action or the plot, as on the character of the chief actor. The dénouement reveals to us, for the first time (as so often happens in real life), the whole man or woman, of whom we find we have had only partial glimpses before, though we thought we knew them well. But we must own that he is sometimes rather tedious in arriving at this point. The reader has great temptation to skip; but, if he does so, he will find that he cannot comprehend the close apart from what has gone before. Though very far from being an immoral, or even an unmetical, writer, Valera sometimes chooses very risky situations; but from the very worst of these—in "Pepita Jimenez"—he draws a fine picture of the remorse of one who, though married to the woman of his heart, and blessed with all that earth can give, yet from time to time mourns over his lost ideal, when he thought to dedicate his life to the service of heaven and of humanity. The most pleasing of his novels is, perhaps, "Día Luz," the last sentence of which admirably rounds off the whole. The marriage of uncle and niece, which closes "El Comendador Mendoza," spoils it for many readers, and is, moreover, we think, faulty in art. After the terrific scene with Doña Blanca, showing the difference between sin to the man of the world and to the deeply religious woman—a scene which slightly paralys

one in Mrs. Gaskell's "Ruth," but is a stronger situation, and far more forcibly delineated—after such a scene, the end, we think, should have been either retirement to a monastery, or a lonely bachelorhood.

Among other poet-novelists are Don José Selgas and Pedro de Alarcon. As far as we are acquainted with them, we deem the verses of the former far inferior to his prose; but some of his novels—e.g., "El Angel de la Guarda"—should be favorites with English readers. Alarcon has written many serious novels, and one most mirth-provoking tale, "El Sombrero de tres Picos," in its way almost a masterpiece; but his best-known work is his "Diario de un Testigo de la Guerra de Africa," giving an account of the campaign in Morocco in 1861. He is one of many writers of Spain whom the social and political events from 1868-74 have driven to reaction. His Jesuits, now, are as impossible in their superhuman wisdom and goodness as are those of ultra-Liberal writers in the opposite extreme. The worthy human-hearted priests of Juan Valera are far more attractive, as well as truer portraitures. Other novelists, such as Perez Galdos, Fernandez y Gonzalez, etc., we must leave for the present.

One of the most interesting results of the tercentenary anniversary of Calderon has been the eight lectures delivered by Menendez Pelayo to the "Círculo de la Union Católica." As a critic, the lecturer is distinguished by impartiality and robust good sense rather than by brilliancy of expression or by dazzling theory. His verdict on Calderon approaches nearer to that of G. H. Lewes than to the unqualified admiration of Schlegel or of Trench. In delineation of character he confesses that Calderon has failed, and especially in his feminine portraitures. His morality he allows to be the conventional morality of Spain in the seventeenth century, which was often opposed to the highest Christian code. In each kind of drama, except in the "Autos," he admits that Calderon has been equaled, or surpassed, by single plays of other Spanish authors; but he claims for him, as a whole, a higher place than can be assigned to any other, by reason of his wealth of poetry, his high philo-

sophy, his lifting every subject to the region of the Ideal, and the serene Christian faith which animates all he writes. He is the third, after Shakespeare and Sophocles, among the world's dramatists.

After all, it is not, perhaps, in lighter literature that Spain is making her greatest advances, but in historical research. Most important aids to the study of Spanish history have lately appeared. The publication by the Government of the "*Cartas de Indias*;" of the "*Indice del Monasterio de Sahagun*," by the "*Archivo Historico Nacional*;" of the notices of some of the "*Becerrojos y Cartularios*" in the same institution, by Don José Fordadada; of the "*Catalogue*" of the 625 Spanish MSS. in the *Bibliothèque Nationale* at Paris, of which the first part has just appeared, by Morel Fatio; the "*Guia de la Villa y Archivo de Simancas*," by Díez Sanchez; the "*Manual de Paleografía diplomática Española*," and the "*Paleografía Visigoda*" of Señor Muñoz y Rivero; not to mention the labors of the veteran Gayangos, and the catalogues or indications of separate collections which have appeared in provincial journals—all these show how earnestly such studies are pursued in Spain.

In original works, the "*Ancient Geography of Spain*," by Fernandez Guerra, which has met the enthusiastic approval of Hübner, is being printed by the Government; and Fernández y González continues the labors of Amador de los Ríos on the Semitic populations of Spain.

In the collection of folk-lore, progress is being made. Señors Delmas and Trueba are working in the Basque Provinces, and so also is V. de Arana (whose "*Leyendas Bascongadas*" are announced for November); in Andalusia several laborers are in the field; in Barcelona the publishers Domenech & Co. have begun a series of works, entitled "*Artes y Letras*," on popular poetry and traditions. We may also call attention to the nicely printed "*Colección de Autores Castellanos*," by Perez Dubrion, Madrid, in which the "*Romancero Espiritual*" of Valdivia and the "*Obras Dramáticas*" of Ayala have already appeared.

We subjoin the two short poems of Nuñez de Arce referred to above :—

A ESPAÑA.

Roto el respecto, la obediencia rota,
de Dios y de la ley perdido el freno,
vas marchando entre lágrimas y cieno
y aire de tempestad tu rostro azota.

Ni causa oculta, ni razon ignota
busques al mal que te devoro el seno;
tu iniquidad, como sutil veneno,
las fuerzas de tus músculos agota.

No esperes en revuelta sacudida
alcanzar el remedio por tu mano,
¡ oh sociedad rebelde y corrompida !
Perseguiras la libertad en vano,
que cuando un pueblo la virtud olvida
lleva en sus propios vicios su tirano.

1866.

EXCELSIOR.

¿ Porqué los corazones miserables
porqué las almas viles
en los rudes combates de la vida
ni luchan ni resisten ?

El espíritu humano es más constante
cuanto más se levanta :
Dios puso el fango en la llanura, y puso
la roca en la montaña.

La blanca nieve que en los hondos valles
derrítese ligera,
en las altivas cumbres permanece
inmutable y eterna.

1872.

WENTWORTH WEBSTER, in *The Academy*.

THE DEVELOPMENT OF ELECTRIC LIGHTING.

1. Parliamentary Blue Book—"Lighting by Electricity," Aug. 13, 1879.
2. Exposition Internationale d'Électricité, Paris. Catalogue Général Officiel Aug. 11, 1881.

The two books, the titles of which we have placed at the head of this article, offer one of the most instructive contrasts in the whole development of science.

In the first we have the opinions of all those who were best qualified to speak two years ago on the prospects of the electric light, and we find a universal consensus of opinion among all the scientific witnesses that, although the electric light was no doubt useful in certain special cases, and although it could be used conveniently where single lights of enormous power were required, yet that its economical subdivision was impossible, and that the application of it in numerous small lights for domestic purposes was the dream of the visionary and the enthusiast.

In the second, published exactly two years later, we no longer deal with opinions but with accomplished facts, and we see that the dream of the visionary and the enthusiast has been realized, and that what was impossible two years ago may be seen in daily action at the Exhibition now open in Paris.

The last two years have witnessed one of those extraordinary developments of scientific industry, of which the latest in any way parallel to the present one has been the development of the locomotive and the railway system. For the stimulus which has caused this development we may say unhesitatingly that we have to thank the genius, power, and insight of Mr. Edison and of our own countryman Mr. Swan.

The present Exhibition in Paris marks an era in the science of electricity. In addition to a great number of other electric inventions, there are collected there, literally, thousands of electric lamps and hundreds of electric generators, representing nearly every kind of electric lighting which has been attempted since Faraday discovered electro-magnetic induction in 1831. In the main building we find various kinds of those large

electric lamps with which in one form or another we have been for some time familiar, while the picture-galleries and reading-rooms attached are lighted by the subdivided lights of Mr. Edison and of Mr. Swan.

Let us, without going too much into details of machinery, examine the generators and lamps by which the electricity is produced and utilized.

The generators may, broadly speaking, be divided into two great classes, those giving "direct" currents, or currents always flowing in the same direction, and those giving "alternate" currents, or currents whose direction is being reversed many times in each second. Each kind has its special uses and advantages, and each is adapted to particular kinds of lamps.

The lamps, again, may be divided into two great classes. The first are the "arc" lamps, where the circuit is broken between two carbon points, and an arc of light is formed between them, produced by the heating of the carbon poles and of the detached particles of carbon forming the arc. The second are the "incandescent" lamps, where there is no discontinuity in the circuit, but where the light is produced by the heating to whiteness of a fine thread of carbon through which the current is passed. All incandescent lamps can be worked either by the direct or by the alternating current; but the arc lamps must again be subdivided into two classes, namely, those which work with the direct and those which work with the alternating current respectively.

The principle on which all electric generators are founded is the fact, discovered by Faraday, that if a wire be moved near the poles of a magnet, so as to move across or "cut" its "lines of force,"* there will be a force produced tending to move electricity, or cause a current to flow from one end of the wire to the other. This tendency is called "electro-motive force." But as long as the two ends of the wire are separated, the

* The directions of lines of force of a magnet may be seen by laying one under a sheet of paper and dusting iron-filings on the top: they will then arrange themselves along the lines of force, which will be seen to radiate from the poles.

electricity can no more flow round than water can flow round a coil of pipe closed at both ends, however strong an "aqua-motive" force (to coin a word) is applied to it by a pump.

But if we either connect the two ends of our pipe one to the other, or if we cause them each to dip into the same or into two separate large ponds, we shall have a flow of water along the pipe as long as our pump supplying the "aqua-motive" force continues to act; and further, if somewhere in the pipe we insert a turbine or other machine, workable by a flow of water, we shall have a motor capable of doing mechanical work; capable, for instance, of turning a grindstone, and causing sparks, giving heat and light, when steel is pressed upon it.

Here, then, we have expended "energy" or "mechanical work" at the pump, and have reproduced that work in the form of heat and light at the grindstone. The stream of water has given us a means of conveying energy from one place to another.

The case of electricity is precisely analogous. If we connect the ends of our moving wire by a conductor, so as to form a complete circuit, or if we connect them both to that great reservoir of electricity, the earth, we shall find that a current of electricity will flow along the wire as long as the "electro-motive force" continues; and further, if we insert in the circuit either an arc or an incandescent lamp, which, like the turbine, offers resistance to the flow, a greater or lesser part of the current will be converted into heat and light at the lamp. But it must be remembered that, when the current is flowing, the magnet resists the motion of the wire, and consequently energy or mechanical work must be expended to move it. This energy passes along the wire in the form of an electric current, and appears as heat and light at the lamp.

Thus we see that the electric wire, like the water-pipe, gives us a means of conveying energy from one place to another; that is, we expend energy in the form of steam-power at the electric generator (all forms of which are machines for moving wires past magnets or magnets past wires), and reproduce it, perhaps two or three miles off, in the form of heat and light in the lamp.

Now it need hardly be said that to move one wire past an

ordinary magnet at an ordinary speed would not produce a very powerful current. The problem of how to construct a generator which will convert the maximum amount of mechanical into electrical energy, with the minimum amount of waste, has occupied the attention of electricians for nearly forty years, and is now in a fair way of solution.

To obtain the greatest possible current, we require to obtain the greatest possible electro-motive force, for the current is proportional to the electro-motive force. We must also have the minimum of "electrical resistance" in the moving wire; that is, we must have the latter as short and thick as possible. It must be remembered that the moving wire and the lamp, or lamps, each offer a certain "resistance" to the current which passes through the circuit, and each convert a certain part of that current into heat, the proportion depending directly on the "resistances" which they offer respectively. Now while all the heat produced in the lamp tends to increase the light, that produced in the moving wire is absolutely wasted, and only tends to injure the machine.

The first condition, then, for a successful electric generator is to have the ratio of the electric resistance of the moving wire to the electric resistance of the lamps as small as possible. The next condition is to obtain the maximum electro-motive force.

It has been proved by Faraday and others that the electro-motive force produced in a wire moving before a magnet is directly proportional to the number of lines of force cut by it in a second. This number depends, first, on the strength of the magnet, for the stronger the magnet the more lines of force emanate from it; secondly, on the length of the wire, for the longer it is the more lines of force it will cut; thirdly, on the velocity with which it moves. In constructing a machine, we wish to make the number of lines cut as great as possible. We see that we can do this in three ways. We can make our magnets very powerful, we can cause the wire to move very rapidly, and, lastly, we can increase the length of our wire by having, instead of a single piece, a spiral or coil of a great number of convolutions, all moving together close to the magnet.

With regard to the first condition, powerful magnets may be obtained in two ways. In his excellently constructed machines, which may be seen in the Exhibition, M. de Meritens uses a large number of extremely powerful steel magnets, whose manufacture has been brought to such perfection that each will support about 150 lbs. weight. Most constructors, however, use "electro-magnets," which are made of soft iron, and have a quantity of insulated wire wound round them, and which become magnetic only when a current is sent through the wire. These magnets give far greater power than can be obtained by any steel magnets. When they are used for electric generators, the current required to "excite" them is sometimes produced by means of a smaller generator with steel magnets, as in the early machines of Wilde, and sometimes, as in most modern machines, a portion of the current produced by the machine itself is sent round its own magnets.

The second condition for producing a great electro-motive force is great speed. But the only way to move the same wire again and again rapidly past the pole of a magnet is to attach the wire to the periphery of a wheel, which by means of a steam-engine can be made to revolve rapidly close to the magnet poles.

The speed with which the wire moves is measured by the number of revolutions per minute multiplied by the circumference of the wheel. It may consequently be increased by increasing either the diameter of the wheel or the speed of revolution, or both. In our opinion, the diameter of the wheel should be the largest allowed by the limits of the size and power of machine required, and the speed of revolution should be increased almost indefinitely. We believe it should only be limited by the strength of the wheel to resist the centrifugal force tending to make it fly to pieces. It is probable that the machines of the immediate future will be made much stronger, and will revolve many times faster than any at present in use.

The third method of increasing the electro-motive force, namely, that of increasing the length of the moving wire, must only be employed with caution and within due limits; for if we

use many turns of thick wire, part of it will be so far removed from the magnets as to be little affected by them; and if we use thin wire, we increase the "resistance," and diminish the current which a given electro-motive force can produce.

The coil of wire passes both poles of the magnet in turn. The electro-motive force, and consequently the current, is in one direction when the wire is passing the N. pole, and in the other when it is passing the S. pole. In the "alternate current" machines these currents are led into the external circuit as they are produced, and the current through the lamp is therefore constantly alternating in direction. In the direct-current machines the currents produced in the moving wire are led to what is called a "commutator," which consists of a number of copper plates, connected to different parts of the wire, fixed on to the axle of the wheel, and revolving with it. On these plates stationary copper "contact brushes" press, and receive the current. The plates are so arranged that all the currents produced in alternate or opposed directions are collected in the same sense at the commutator, and consequently all the currents are delivered into the external circuit in the same direction, and the current through the lamp is what is called "direct." Both classes of machines have their proper uses, which we shall presently discuss.

The principal direct-current machines now in actual commercial use are those of Gramme, Siemens, and Brush, and to these may be added the new Bürgin machine lately introduced into England by Mr. Crompton.* Although it is impossible without diagrams to give any adequate idea of the differences of construction of these machines, their general principles may be summed up in a few words.

They all employ electro-magnets excited by a portion of the current produced as before explained, their chief differences being in the way in which the moving wire is arranged.

In the Siemens machine it is wound on a long reel, not,

* We hear that Mr. Edison has also constructed a powerful machine, but it has not yet been exhibited in England.

however, round it, like the cotton on a cotton-reel, but from end to end parallel to the axis of revolution, so as to form a kind of cylinder or roller, which in the largest machines may be perhaps 8 inches in diameter and 18 long. The poles of the electro-magnets are made wide and flat; in fact, they are generally cut out of strips of iron boiler-plate, as wide as the moving cylinder is long. Thus the whole length of the wire moves parallel to itself right across the lines of force emanating from the magnet.

In the Gramme machine the revolving piece consists of a wheel with a flat iron rim, perhaps 3 inches wide, round and round which rim the wire is wound. The method of winding may be seen by taking a strip of whalebone, winding cord or wire round it in a spiral from end to end, and then bending the whalebone so as to form a ring. This ring revolves between the poles of two or four electro-magnets similar to those of the Siemens machine, but not so wide in proportion to their bulk.

These two types of machine are each suitable for producing a single light of great power—of, say, from three thousand to ten thousand candles; but, as far as we are aware, the makers have not yet succeeded in constructing direct-current machines with sufficient electro-motive force to burn more than one or at the most two arcs on one circuit.

The difficulty of giving a high electro-motive force to this type of machine is found in the fact that, the wires being all wound close together in one coil, there is, when a high electro-motive force is used, a great tendency for the electricity to move sideways out from one wire to others lying near it, and this is apt to break through the insulation and destroy the machine.

In the Bürkin machines the wire is wound on iron rings, as in the Gramme; but instead of being wound on one large ring, it is wound on from six to ten smaller ones. By this means a high electro-motive force can be obtained safely, and the machines now made by Mr. Crompton burn four lights of 2000 candle-power each on one circuit. They are extremely suitable

for all purposes where a comparatively small machine is required.*

The commutator, which is used in all direct-current machines, deserves special mention. It was invented in Italy in 1860 by Professor Paccinotti, and described by him in 1863.† He did not patent it, so it is now common property. Let us consider, for instance, a Gramme machine, having its magnet-poles on the right and left of the ring, and their line of separation vertical. The spiral of wire on the ring is moving upward past one pole and downward past the opposite pole. The electro-motive forces induced in the spirals on the two halves of the ring are therefore in the same absolute direction—that is, either both downward or both upward; for, as the electro-motive force is reversed, either by changing the direction of motion or the polarity of the pole, changing them both reverses it twice—that is, does not alter it at all. Thus in the two halves of the spiral on the ring we have two electro-motive forces in the direction shown by the



arrows. We see that though they are in the same absolute direction, they are opposed to each other in the ring, and therefore cannot cause a current to circulate round it. Professor Paccinotti's invention consisted in arranging a number of strips of copper all round the axle of the machine and connecting each one to that portion of the spiral on the ring which is immediately opposite to it. Two "contact-springs" or "contact-brushes" are placed so as to press respectively on the plates in turn, as they come to the positions *a* and *b*. The two currents then, instead of being opposed in the ring, flow out side by side into the contact-brush at *b*, pass through the line-wires and lamp, and return by the other contact-brush at *a*.

* They will burn from forty to fifty incandescent lamps of 16 candle-power each, sufficient, for instance, for a moderate-sized country-house. They use about 4½ horse-power.

† "Nuovo Cimento Giornale di Fisica, di Chimica e delle loro applicazione alla Farmacia ed alle Arte industriali," compilata dai Proff. C. Matteucci, R. Piria (e G. Meneghini). Tom. XIX. Pisa e Torino, 1863, p. 378. This volume of *Il Nuovo Cimento*, containing Prof. Paccinotti's paper and diagrams, has been exposed in the library of the Royal Institution in Albemarle Street ever since its publication in 1863.

Professor Paccinotti's models exhibited in 1864 are now in the Exhibition in Paris, and are almost identical with the direct-current machines which are at present in use.

We now come to the Brush machine; certainly the most powerful direct-current machine at present in the market. The magnets are of the same general type as in the other machines, but the revolving part of the machine consists of a large thick iron wheel, out of the rim of which a number of deep notches are cut. In these notches the wire is wound, forming a number of separate coils.

The chief feature, however, in which it is claimed that the machine of Mr. Brush differs from all others, is the following: The Brush Company state that "in all other machines, though only a portion of the moving wire is being acted on by the electro-magnets, the current produced has to pass through the whole of it, namely, both through the portion in which it is being generated and the idle portion which is waiting its turn to come between the magnet poles. All this wire offers resistance and enfeebles the current. In Mr. Brush's machine the Paccinotti commutator is so modified that the idle portion of the wire is always cut out of circuit, and the current only passes through that portion of the wire in which it is being generated." They consider that this invention enormously increases the efficiency of the machine. Mr. Brush now constructs machines, one of which is at present in the Exhibition, which burn on one circuit no less than forty arc lamps, each of the power of from 800 to 1000 candles. The weight of the machine is about two tons, and it takes about 30-horse power to work it. This machine is distinguished not only by the solidity of its construction, but by the amount of finish and ornamentation bestowed on it externally.

There is a real and somewhat curious reason for the extra expense thus incurred, which was recently explained to us by Mr. Brush himself. He says:—

I have always found that the only way to ensure that my machine shall always be kept in good order and efficiency, and free from grit and rust, is to make it externally so handsome that the man who has charge of it shall get fond of it, and take

such a pride in it that he will clean and polish it from day to day to prevent its appearance from deteriorating.

Side by side with the "Forty-Lighter" in the Exhibition stands another, exactly similar in size and appearance, but wound with a much thicker and shorter wire, and arranged to use its whole current in burning one gigantic lamp for lighthouse illumination. This lamp is about 5 feet high by 4 feet square. The current is led to it by copper ropes $\frac{1}{4}$ inch in diameter, and the carbon rods are no less than $2\frac{1}{4}$ inches in diameter. We have not personally had the opportunity of seeing it in action, but we understand that it gives a light of the power of 150,000 candles.

As showing the rapid strides with which electrical engineering has advanced, the following anecdote may be mentioned: Near the "Forty-Lighter" in the Exhibition stands a three-light machine, having the appearance of a small toy. Mistaking this for a model, we inquired of Mr. Brush whether he had it constructed only for lecture purposes, or whether it was an actual working machine; but we were informed that it had been constructed three or four years ago, in order to see how large a machine it was possible to make; "and," he added, "a very big thing every one thought it in those days, and came long distances to see it."

Although we are, no doubt, very far as yet from the largest machines that will be made—for probably the big machines of to-day will be the toy models of three years hence—yet with the forty-light machine we have probably reached the useful limit of arc-lighting on one circuit; for it must be remembered, when a number of lamps are on one circuit, that if any accident occurs to the wire, or to any one of the lamps, sufficient to interrupt the current, the whole of the lamps will be extinguished: for this reason, when a large number of arc lamps are required, it is better to have either several separate machines, or one machine going several separate circuits. Now, no satisfactory direct-current machine has yet been constructed to give more than one circuit, for each separate circuit would require a separate commutator and a separate set of contact-brushes. As these are by far the most troublesome parts of a machine, it has been as yet

found more advantageous, when two circuits are required, to use two separate machines. For the alternating current, however, no commutator is used, and an alternating current machine can be made to give as many circuits as are required.

The principal alternating machines now in the market are the alternating Gramme, the Lontin, the alternating Siemens, and the De Meritens.

In the two first-named machines a number of electro-magnets are fixed radially on an axis, and revolve inside a fixed barrel, to which a number of coils of wire are attached. The electro-magnets are excited by the current of a separate small direct-current machine of any convenient type. In each one of the fixed coils on the barrel alternating currents are induced, and a separate circuit can be led away from each coil. Each coil can be made to feed one or several lamps, according to the power of the machine and the size of the lamps, or several coils can be attached to one large lamp. Large and small lamps can, therefore, be fed simultaneously. The accidental breaking of the wire of any one circuit only extinguishes the lamps on that circuit, and does not in any way affect those which are being fed from the rest of the machine.

In the alternating Siemens, the coils are fixed all round the circumference of a wheel which revolves between two fixed wheels, each carrying a number of small electro-magnets.

In the De Meritens machine the wire is wound on an iron ring, as in the Gramme machine; but the ring, instead of being made in one piece, consists of a number of segments which are bolted together after being wound. This makes the winding a much easier process than when the reel off which the wire is being drawn has to be passed through the ring at each turn. In this machine steel magnets are used, and are set close together radially all round the outside of the ring. In the standard size of the machine there are five rings, each half a meter in diameter, and each ring is surrounded by sixteen horse-shoe magnets. In its action the machine leaves nothing to be desired, as its current is absolutely steady and uniform, and it never seems to get out of order. A five-ring machine is now working the two

lighthouses on the South Foreland, and another may be seen in the Exhibition, working the large model lighthouse set up in the middle of the building.* The machine is very economical of horse-power, but is somewhat heavy and expensive (as regards first cost) compared to other machines doing the same amount of work. The five-ring machine weighs two and a half tons.

When it is desired to supply several separate circuits from this machine, or from the alternating Siemens, wires are led from whatever number of coils each circuit is to consist of, and are attached to insulated metal rings fixed on the axle. Springs pressing on these take off the currents to the different external wires. This plan is as convenient as that of fixed coils, for small machines such as are now constructed; but when very large machines are required, they are better made with moving magnets and fixed coils, as they can then be conveniently constructed of gigantic dimensions, and arranged to supply a large number of independent circuits.

Passing now to the lamps, we commence with those suited for "arc" lighting. In all these lamps there is a steady, though slow, consumption of the carbon rods between which the arc is produced. The points have to be brought in contact to start the current, then separated for $\frac{1}{4}$ inch or so, so as to form the arc, and then they have to be fed forward as they burn away, so as to keep the "resistance of the arc," and consequently the quantity of current and the light produced, as nearly constant as possible. On the steadiness and sensitiveness of the feeding machinery depends the steadiness and freedom from flickering of the light.

The general principle of all arc regulator lamps is the following: Before the lamp is lighted the carbons are in contact. The current being sent through them, passes on its way through a small electro-magnet, which, pulling a lever, separates the carbons and forms the arc. As soon as the carbons are a little burnt away, the arc, becoming longer, offers more resistance, and diminishes the current. The current, which has all this

* This machine will work 150 Swan lamps.

time been passing through the electro-magnet, is no longer able to hold a second lever, which is pulled away from it by a spring. As it flies away it releases a train of wheelwork actuated by the weight of the upper carbon, and the carbons approach; and, the arc getting shorter, the current gets stronger, and the magnet again pulls its lever and stops the wheelwork.

In the old lamps this adjustment used to take place once or twice a minute, and the sudden increments and diminutions of the length of the arc produced those flickerings which were so much complained of in the early days of electric lighting, two years ago. In the best modern regulators, such as those of Mr. Crompton, the adjustment takes place every one or two seconds, and the light is practically steady. When several regulators are placed upon one circuit, an ingenious plan is arranged for preventing the motions of one regulator affecting the rest.

This type of regulator may be arranged for use either with a direct or with an alternating current. It must be noted, however, that with the direct current the positive carbon consumes away about twice as fast as the negative, while with the alternating current the consumptions are of course equal. Owing to the fact that there is a slight difference in the actions of an electro-magnet with direct or alternating currents, the lamps must be specially adjusted for the direct or alternate current; that is, a lamp adjusted to work with the one will not as a rule "feed" regularly with the other.

In addition to the regulators where the carbons are placed end to end, must be noted the Jablochkoff candle, which consists of two carbon rods placed side by side, and separated by about $\frac{3}{16}$ inch of plaster. The rods are placed vertically, and the arc being established between them at the top, the plaster consumes away with the carbon, and the whole burns away downward like a candle. The candle can only be used with an alternating current, as it is of course necessary that the two carbons should consume at the same rate.

The arc lights give powers of from 500 to 150,000 candles, and are suitable for lighting streets, stations, and large buildings. They are not suitable for domestic lighting; first, because they

are not sufficiently subdivided, and the glare of them in a room would be intolerable; and secondly, because skilled labor is required to put in new carbon rods every day.

The great difficulty up to two years ago was to obtain anything like an economical subdivision of the current. The opinion of scientific men was universally against its possibility, as may be seen by reading the evidence of the scientific witnesses examined before the House of Commons early in 1879.* But, as has fortunately happened on several similar occasions, there were inventors then at work who, while we must claim them as being men of science in the highest sense of the word, were yet unscientific enough not to be able to comprehend the clear proofs of the impossibility of what they desired; and at the end of 1879 Mr. Edison in America, and Mr. Swan in England, simultaneously produced practical systems of subdivision.

These systems are now both being developed with a speed only limited by the time required to train workmen to a new branch of industry, and to make the commercial arrangements for bringing them within reach of the public. While the system of Mr. Swan is being rapidly adopted in England, in America Mr. Edison is laying down wires and building generating-stations to light the whole of the houses in New York City, having contracted to supply the light by meter at the same price as that formerly paid for gas.

The principle of both Mr. Edison's and Mr. Swan's systems is the same. In each case the lamp consists of a fine filament or thread of carbon, about $\frac{1}{100}$ to $\frac{3}{100}$ inch in diameter and $1\frac{1}{2}$ to 5 inches long, fixed inside a glass globe. The ends of the carbon are connected to metal wires which pass out through the glass and are hermetically sealed into it. Every trace of air is removed from within the globe, which is then sealed. On a suitable current of electricity being sent through the carbon thread, it becomes white-hot and glows, giving about as much light as a gas-jet.

The great difficulty which had to be overcome in making these

* Blue Book, "Lighting by Electricity," June 13, 1879.

"incandescent" lamps was the obtaining of a filament of carbon fine enough to be of sufficiently high resistance and which would last a very long time without disintegration. The method which has been adopted in the construction of all lamps of this class has been to form the filament from some kind or other of tough vegetable fiber, and then to convert it into carbon by heating it to whiteness in a crucible, from which the air is excluded.

In Mr. Edison's lamps, as at present constructed, the carbons are formed from thin strips of bamboo, while Mr. Swan sometimes uses cardboard and sometimes cotton-thread. The carbon filament, in the form of a horse-shoe, has its ends attached to two little blocks of thicker carbon, which in their turn are attached to platinum wires melted into glass tubes. The carbon loop with its end pieces is then put into a glass globe about 1½ inch diameter, the neck of which is melted down upon the glass tubes so as to close the whole air-tight. It will be understood that the platinum terminal wires project out through the glass, and give a means of connecting the lamp to the line wires supplying the current.

The next process is the removing of the air from the globe, which is done through a small aperture by means of the various improved air-pumps which have been constructed for the purpose by the inventors of the lamps. It was soon found that, however perfect a vacuum was produced by the pump, yet the first time the lamp was used, this vacuum became impaired; the reason being that the carbon itself contained a certain quantity of gas and vapor, which by the heat was driven out into the bulb. The least trace of gas in the globe soon causes the destruction of the carbon. The following process was therefore adopted: While the lamp is still attached to the pump, a current is sent through the filament so as to raise it to as high or to a higher degree of incandescence than will be used in actual work. The gas driven out is at once removed by the pump, and the lamp is sealed while the filament is still hot.

In the Maxim and the Lane Fox lamps the process of manufacture is nearly identical with those of Swan and of Edison, but the filaments are heated by means of an electric current in

an atmosphere of oil-gas or coal-gas. This decomposes the gas, and causes carbon to be deposited on the filament; and as, if the filament is not of uniform thickness, the thinnest parts will get hottest, there will be most carbon deposited on those parts, and the thickness will become more nearly uniform. By a proper application of this process, Mr. Lane Fox is enabled to make the resistance of all his lamps exactly equal.

The cost of making an Edison lamp is said to be about two shillings, and it lasts about seven months before the filament breaks down, after which it can be repaired for about one shilling. In case of a lamp breaking down, it can be removed and a new one attached by any servant, for the contact springs inside the chandelier brackets, both in the Swan and Edison systems, are so made that screwing the lamp into its place makes the electrical contacts automatically. The current is turned on and off by a tap exactly similar externally to an ordinary gas-tap. The only difference between lighting an electric light and a gas-jet is, that in the former case it is not necessary to strike a match.

Incandescent lamps can be worked either by the direct or by the alternating current, and, other things being equal, they work best on whichever machines run most uniformly. Mr. Edison has, however, found that when the direct current is used there is a constant, though very slow, transference of carbon from the positive to the negative heel of the horse-shoe filament, and therefore that the lamps ultimately break down close to the positive end of the loop. With the alternating current the wearing away is uniform at both sides, and the lamps last longer.

For domestic lighting it is, of course, necessary to connect a great number of lamps to one pair of wires. To find the best way to do this is a matter of great importance.

One way is to connect the lamps "in series;" that is, all on one line; so that the whole current passes through every lamp. This requires a very feeble current, only enough to light one lamp, but a very great electro-motive force to drive this current through the whole series. It is open to the fatal objection, that the break-down of any one lamp extinguishes the whole.

Another way is to connect the lamps "in quantity;" that is, the two wires of the circuit are put side by side, and each lamp forms a little independent channel from one to the other. This requires a great quantity of electricity, as a separate flow goes through each lamp, but a very low electro-motive force, as, owing to the number of channels through which the current is flowing, there is but little resistance to its passage. In fact, any number of lamps require only the same electro-motive force as a single one. Here, if one lamp breaks down, the rest are not affected.

The difference between the two systems may be understood from the analogous case of the two ways in which a number of small water-wheels might be driven. Suppose we have fifty wheels. We can represent the connection "in series" by arranging a flow of water just sufficient to drive one wheel, and by placing the whole fifty one above another from the top to the bottom of a hill. The water will flow from each one to the next below it, and so will drive them all. The quantity of water here corresponds to the quantity of electricity, and the height of the hill to the electro-motive force. Here also we see that if any one wheel becomes choked, so as to stop the flow, all the wheels will stop.

To represent the connection "in quantity," we must suppose ourselves to have two channels cut along the side of the hill. The upper one is to carry fifty times as much water as in the previous case, but is only to be 1-50th of the height of the hill above the lower one. The fifty wheels will then all be placed between the two canals, so that fifty separate little flows of water run from the upper canal to the lower, each through one wheel. Here we see that the choking up of one wheel will not affect the rest.

Further, let us suppose that the flow is kept up by means of a pump, raising the water up again as it runs down. We notice that the same horse-power will be required in each case, for in one case we shall have to pump a certain quantity of water to the top of the hill, and in the other to pump fifty times the quantity to 1-50th of the height. Similarly, in the case of elec-

tric lighting, to work a certain number of incandescent lamps* takes sensibly the same horse-power, whether they are arranged "in series" or "in quantity."

We see that we could use various systems of connection intermediate between the two we have described. For instance, our two hillside canals could be made with twice the difference of level and half the quantity of water, and the water could flow through twenty-five channels, each working two wheels in series. Combinations of this kind are very frequently used in arranging lamps for domestic lighting.

In all the methods of producing electric light which we have described, the current is supplied as it is produced, by means of an engine continuously working; and this will, no doubt, be the most economical plan when the electricity is supplied on a large scale. In certain cases, however, the form of secondary battery constructed by M. Faure for the storage of electricity will be of very great value. As it has been recently fully described in the *Times* by Sir William Thomson, and in our contemporary the *Edinburgh Review*,† we will not trouble our readers with a detailed explanation; but they will remember that by means of it a large quantity of electricity can be stored for an indefinite time in leaden plates, and can even be carried about and delivered in houses in the same way as oil or fuel. The great weight of lead required to store any considerable quantity of electricity will, in the present state of the invention, preclude the extended use of it for the latter purpose; but it will, no doubt, be of very great use for purposes such as the following.

In many country-houses there is a steam-engine to do the pumping, which is attended to by the gardener or some other

* To prevent misconception, we may here note that arc lamps can only be worked "in series." If two are placed "in quantity," the whole of the current goes by one or the other, and does not divide between them. The reason is that, the conductor being severed in two places, the whole current leaps over the lesser interval of resistance; but in the other case, the conductors being all continuous, it distributes itself through the whole number.

† July, 1881.

person not giving his whole time to it. If this engine is used for electric lighting by the ordinary means, a man has to be employed to attend to it at night as long as the lights are burning. By the use of the Faure battery, the gardener will be able to fill his water cisterns and his electric cisterns with one heating of the boiler in the morning, leaving supplies of both water and electricity equally ready to be used as required at night after he has left work.

As soon as electricity is supplied to two or more houses from the same machine, it becomes necessary to measure the quantity supplied to each house respectively, in other words, to supply the electricity by meter. Our gas-meter shows us the number of cubic feet supplied in a day ; a water-meter shows us the number of gallons; in both cases we measure the quantity supplied. We see that, if we increase the gas or water pressure, more gas will pass in a given time through a pipe of given bore and length, and the strength of the stream will be increased. Again, if we increase the bore of the pipe and so diminish its resistance, the strength of the stream will be increased. In the case of gas, we can measure the pressure and the quantity of gas delivered, but we have no means of measuring the resistance of the pipe or the strength of the stream. In the case of electricity, however, we can measure each or all of these four quantities, namely, pressure or electro-motive force, quantity, current, and resistance; and, as these are all connected one with the other by perfectly simple and well-known laws, we need only measure two,* and then we can deduce the others from them.

The units are derived from theoretical considerations which we will not now touch on. We will simply give their names and a rough idea of their physical magnitudes. Their actual values are such as to connect them exactly with the metrical system now used in all scientific measurements, and in commerce on the Continent. The definitions which we are giving are the revised ones adopted by the Congress of Electricians which met in Paris on September 15 of this year.

* One of these two being either electro-motive force or resistance.

Our first unit is the unit of electro-motive force, corresponding to the unit of water pressure or "aqua-motive" force. It is called the "Volt." One cell of the batteries commonly used for electric bells has an electro-motive force of about one volt: 60 to 70 volts are required to maintain satisfactorily an arc between carbon poles.

The unit of electrical resistance is called the "Ohm." It is represented by the resistance of a column of mercury of one square millimeter in section, at a temperature of 0° C., and of a length which is known to be between $104\frac{1}{2}$ and $105\frac{1}{2}$ centimeters, and which is to be accurately redetermined immediately by an international Commission appointed at the late Congress.

A mile of No. 16 copper bell-wire has a resistance of about 14 ohms. The Atlantic cable has a resistance of about 7,600 ohms. The resistance of the arc between carbon poles varies from perhaps 2 ohms for a large lamp with thick carbons, to 7 or 8 ohms for a small lamp. A Swan incandescent lamp, when cold, has a resistance of about 80 to 50 ohms, according to the size of the lamp. When hot, the resistance is reduced by about one half.

The unit of current is called the "Ampère."* It is the current that one volt can send through one ohm. Two volts would send two ampères through one ohm, or one volt would send half an ampère through two ohms. Thus an electro-motive force of 60 volts would send a current of 10 ampères through an arc having a resistance of 6 ohms. This is about the condition which exists in the Brush lamps at Charing Cross Station. The Swan lamps require from 1 to $1\frac{1}{2}$ ampère, according to size.†

The unit of quantity is called the "Coulomb." It is the quan-

* This is the same as the unit of current hitherto called the *Weber* in England; the name was changed in deference to the wishes of the German members of the Congress, who had been in the habit of using the word "Weber" in a different sense, and hence feared confusion.

† It must be remembered that the amount of heat produced in the lamp and used in the steam-engine is as the square of the current; i.e., 2 ampères produce and require for their generation 4 times the heat that one does.

tity of electricity conveyed in one second by a current of one ampère. Hence one of the Charing Cross lamps using a current of 10 ampères consumes $60 \times 60 \times 10 = 36,000$ coulombs per hour.

One-horse power of energy can maintain a current of one ampère through a resistance of 746 ohms; or it can maintain a current of about 27.3* ampères through one ohm. It would just maintain 10 of the smaller Swan lamps. A current of 10 ampères through an arc of 6 ohms' resistance, which is used in the Brush lamps at Charing Cross, is equivalent to a current of one ampère through $6 \times 10 \times 10 = 600$ ohms, and thus takes a little less than 6-7ths of a horse-power, and this is found to be the case in practice.

The quantity of horse-power consumed in the form of electricity in each house can then be measured, if we have a means of recording the strength of current at each instant, and the time during which it was turned on, the electro-motive force of the generating machine being kept constant. One class of current meters record in this manner. They consist of a pencil moved up and down by the current, rising higher when the current is stronger, this is, when more lamps are turned on, and falling to the bottom of the scale when the current is interrupted. This pencil presses on paper wound on a drum, which is made to revolve round a vertical axis by clockwork. It thus traces a wavy or sinuous line. The total current used in the house is proportional to the area of the paper below the wavy line.

Another class of meters measure simply in coulombs the total quantity of electricity which has passed through. A small known fraction of the current, say $\frac{1}{1000}$ or $\frac{1}{10000}$ of it, is sent through an apparatus, consisting of two copper plates immersed in a solution of sulphate of copper. Copper is deposited from the solution on one of the plates, which is weighed at intervals.

* 27.3 - $\sqrt{746}$ nearly; the formula being, horse power = $\frac{C^2 r}{746}$, where C is the current in ampères and r the resistance in ohms.

Its gain in weight is proportional to the total quantity of electricity which has passed through. This also, when the electro-motive force is kept constant, is proportional to the total quantity of work produced by the steam-engine which has been expended in the house.*

To make this clearer, let us consider the parallel case of a company supplying motive-power to a number of workshops, by pumping water to an elevated cistern, and leading pipes from the cistern to a water-engine in each workshop. As long as the height of the cistern, that is, as long as the pressure or "aqua-motive force," is kept constant, the quantities of mechanical work (previously expended in raising the water) used in each workshop respectively will be correctly given by meters showing the total quantity of water which passes through all the water-engines in that shop; but if the pressure or aqua-motive force is increased by using a more elevated cistern, then a given quantity of water would require more work to raise it, and would be able to do more work in descending through the water-engine; in fact it might be possible to send it through twice the number of water-engines by placing two "in series." Similarly, if we double our electro-motive force, lamps of double resistance, or

* The mechanical work, W , in foot-pounds, expended in sending Q coulombs of electricity through a circuit by means of an electro-motive force of E volts is $W = \frac{550}{746} EQ$. Hence one of the Charing Cross lamps (p. 30), using 10 coulombs

per second, with an electro-motive force of 60 volts, uses $\frac{550}{746} \times 60 \times 10 = 44\frac{1}{2}$ foot-pounds of energy per second. As another instance, let us suppose that in a particular house we have been burning 20 Edison lamps for about 6 hours a night for a week. Each lamp uses about $\frac{1}{2}$ of a coulomb per second, and thus at the end of the week our meter would show that we had used in all about 3 million coulombs. The electro-motive force of Mr. Edison's machine being 110 volts, we should have used in all $\frac{550}{746} \times 110 \times 3,000,000 = 243$ million foot-pounds of energy. Now one horsepower develops 1,980,000 foot-pounds per hour, and we may consider that for every horse-power developed in the lamps about $3\frac{1}{2}$ lbs. of coal per hour are burnt in the furnaces of the steam-engine. Our meter therefore shows us that our 20 lamps have in their week's work used $\frac{243,000,000}{1,980,000} \times 3\frac{1}{2} = 409$ lbs. of the coal burnt in the furnaces of the Company's engine.

two lamps in series, might be used, thus giving double the light, while only the same number of coulombs of electricity passes through the meter. It is therefore necessary, when a company is supplying electricity by meter, that they should keep the electro-motive force in their street mains as constant as possible.

With regard to the extended use of electric light in houses, two questions are constantly asked. First, can the glare be got rid of? Second, what is the cost as compared to gas? Now there is nothing whatever in the nature of the electric light to cause the glare that is so often objected to: the only reason of the glare is, that persons who are accustomed to have in their drawing-rooms perhaps 40- or 50-candle power gaslight are not satisfied unless, when they substitute an electric light, they can show a great superiority in the illumination as compared to that given by the gas; they therefore remove their 50-candle gaslight, and substitute 700- or 800-candle power electric light. There is then naturally a glare, which is extremely trying both to the eyesight and to ladies' complexions. When, however, people will be content to substitute for their 50-candle power gaslight 80- to 90-candle power electric light, they will find that they have a beautiful soft light, which, if the shape of the lamps is hidden by a shade, it is impossible to distinguish from gas, except that it is steady and does not vitiate the air. We had lately an opportunity of seeing the incandescent light in actual use in the drawing-room of a country-house which was lighted by thirty Swan lamps. They were unshaded, and hung equidistant from one another all round the room, about two feet from the walls, and one foot from the ceiling. There was no glare and no consciousness of any particular lamp, but it was possible to read comfortably in any chair in any position in the room.

We now come to the question of expense. With regard to street lighting, where the arc is used, it is already, light for light, unquestionably cheaper to light by electricity than by gas, as may be seen by noting the prices paid for the lighting of the City of London, where, taking one company with another, the annual charge is about the same as that previously made by the gas companies, and the quantity of light about four times as

much as that given by the gas, while the electric light companies are all paying good dividends. Sir Wm. Thomson has given it in evidence before the House of Commons,* that the quantity of gas, which, if burnt directly, will maintain a light of 12-candle power, will, if burnt in a gas-engine, develop just 1-horse power, and, if employed to turn a generator, will produce a current of electricity which is able to maintain an arc of 1600-candle power. The same engine, if used to supply the present incandescent lamps, would give with the same quantity of gas about 160-candle power.

To the cost of the electric light must, however, be added the charge for interest on the plant and profit to the inventors, and in the case of the arc lamps, the cost of the carbons consumed. To this again must be added those various items for attendance, etc., which will be much greater for electricity than for gas, so long as, but no longer than, electricity is produced on a very small scale, and gas on a very large one. In fact, to estimate what will shortly be the relative cost of lighting a house by gas and by electricity, we ought, if we estimate the cost of the electricity at its present price, to estimate the cost of the gas, not at what it now costs, but at what it would cost if each consumer had to erect and maintain private gas-works in his own back yard. In a year or two's time, when the electric-light mains are laid in every street in London, we shall find that the actual relative cost of gas and electricity is not far off the numbers which we have given above.

At the present time Mr. Edison is engaged in laying down nearly 500 miles of electric-light mains in New York City, and he has undertaken to light every house by means of his incandescent lamps, and to charge to the consumers exactly the same as they have up till now been paying to the gas company. The inhabitants will therefore, without extra expense, obtain a light which does not vitiate or heat the air, and with which paint and decoration will last at least three times as long as when gas is burned in the rooms.

* Blue Book, Aug. 13, 1879.

We have stated that the heat consumed in developing 1-horse power of energy, will, when employed to produce light, give the following quantities according to the method of its employment:—

Gas burnt directly.....	12 candles
Gas burnt in a gas-engine working { an arc lamp.....	1600 “
an electric-generator-supplying.. }	10 incandescent lamps..160 “

The whole explanation of these great differences is to be found in the different temperatures at which the heat is employed in the three cases. A quantity of heat, however large, if employed at the temperature of a hot-water pipe, produces no light at all. The same quantity employed in making a poker red hot would give a little light. Now, the light of a gas flame is produced by the heating to whiteness of the particles of carbon in the gas, but the temperature of a gas-flame, as compared to that of an electric light, is extremely low, and therefore the light is extremely uneconomical. The temperature of the carbon filament in the Swan and Edison lamps is very much higher than that of the carbon in the gas-flame, and consequently the light is much more economical, while the temperature of the electric arc is so enormous, that the relative heat economies of it and the gas are expressed by the ratio of 1600 to 12.

The reason that the incandescent lamps are so much less economical than the arc lamps, is that they have to be worked at a much lower temperature. It is found that, as the carbons are at present constructed, any considerable increase of temperature causes the speedy destruction of the filament. As the construction of the filaments improves, the lamps will be able to be worked at a higher temperature, and be so much the more efficient.

We may, however, even now confidently look forward to the time in the immediate future when gas-lamps for lighting purposes will be as obsolete as wooden torches, when every street in London will be lighted as brightly as Cheapside is at present,

and when in every house the incandescent lamp will be substituted for the gas-jet.

As soon as gas is no longer required for illumination, the companies, no longer having to refine it, will be able to supply it for fuel at a very small fraction of its present price; and while the substitution of electricity for gas as an illuminant will give us light, health and coolness in our rooms, the substitution of gas and coke for raw coal as fuel will remove the cloud of smoke which hangs over London, and make the November fogs a thing of the past, which we shall describe to our children as a tradition of what were literally "the dark ages."—*London Quarterly Review.*

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